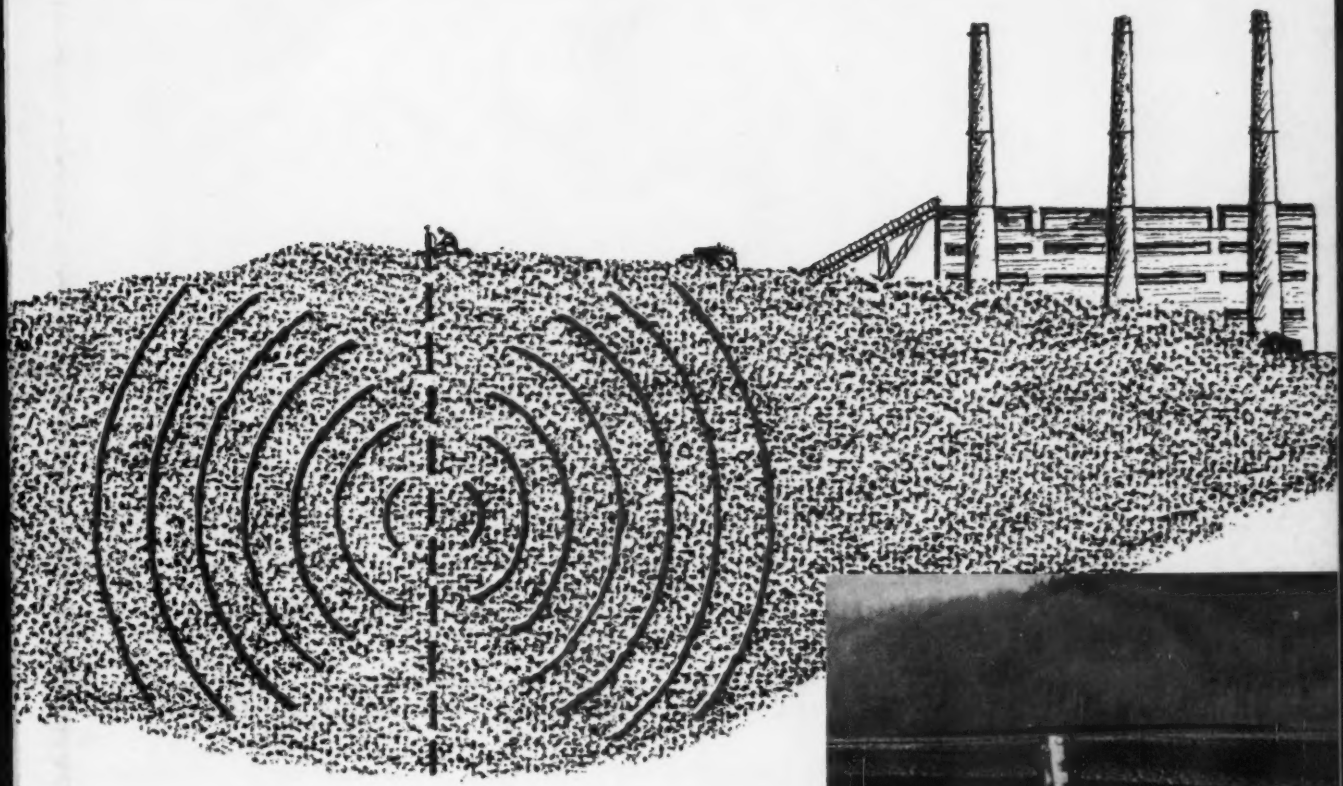
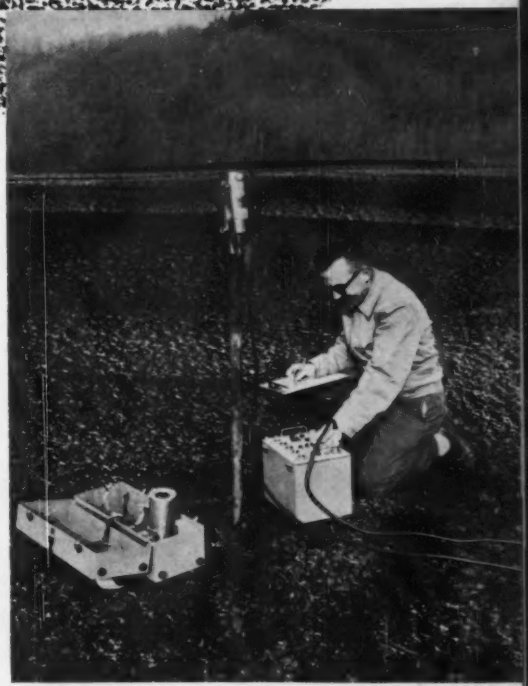
The Electrical Industry's Weekly Magazine September 5, 1960

Electrical World

Price 50 Cents

A McGraw-Hill Publication





How Coal Pile Density is Measured by Radioactive Probe

. . . page 34

PRICES AND THE ANTITRUST ACTIONS

First in a series of three articles . . . page 65

UNIV MICROFILMS INC GS
EDITORIAL DEPT
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ANN ARBOR MICH C 4

General Electric reports on developments in . . . **POWER GENERATION**

THE MAGNETIC TAPE-CONTROLLED MILLING MACHINE above is being set up for production of the new 50-inch buckets. This is the first application of numerical control for machining complex-shaped steam turbine buckets. This new manufacturing technique will result in stronger, more efficient, more economical buckets.

FIRST 50-INCH TURBINE BUCKET

THIS G-E ENGINEERING TEAM was instrumental in the development of the 50-inch bucket. Left to right, V. S. Musick, J. H. Ouellette, (standing), A. Rubio, J. E. Corr.

GENERAL ELECTRIC is building for 1961 shipment the first 1800-rpm steam turbine with 50-inch last-stage buckets. This latest milestone in turbine design was achieved through the use of new, advanced mathematical design techniques. Extensive laboratory tests were conducted to assure that the new bucket will maintain the high-reliability and long-life qualities of its predecessors.

IMPROVED EFFICIENCY AND HIGHER RATINGS are made possible by the 50-inch bucket. The increased exhaust area permits better utilization of last-stage steam energy and can result in efficiency gains of 1% or more over the present 43-inch last-stage bucket. Higher unit ratings can now be attained without increasing the number or complexity of turbine casings. For example, the ratings of many cross-compound turbine arrangements can be extended as much as 33%.

REDUCED POWER GENERATION COSTS will result from the 50-inch bucket—and from General Electric developments yet to come. By co-ordinating its engineering research, development, and design efforts with those of electric utility engineers, and by making available new and better apparatus for generation, transmission, and distribution, General Electric will continue to help utilities meet America's rapidly increasing demand for low-cost power. 604-06

GENERAL ELECTRIC

Electrical World

Vol. 154, No. 10 SEPTEMBER 5, 1960

Published for 86 years for those engaged in the business of generating, transmitting, distributing, or applying electric power

In This Week's Issue

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Round-up analyzes prospects for private and public power Congressmen in November ..... p 26

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Evolution of higher-voltage systems requires careful selection of relays ..... p 32

GENERATION

Measure Coal-Pile Density, Moisture

B. B. Bonadio, Indiana-Kentucky Electric Corp; A. S. Grimes, American Electric Power Service Corp; H. L. Lamphier, Ohio Valley Electric Corp

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MANAGEMENT

Today a Cadet, Tomorrow a Boss

Con Edison looks to future, seeks to meet power demand growth with carefully-trained personnel ..... p 37

SUBSTATIONS

Speeds Load Projection, Unit Planning

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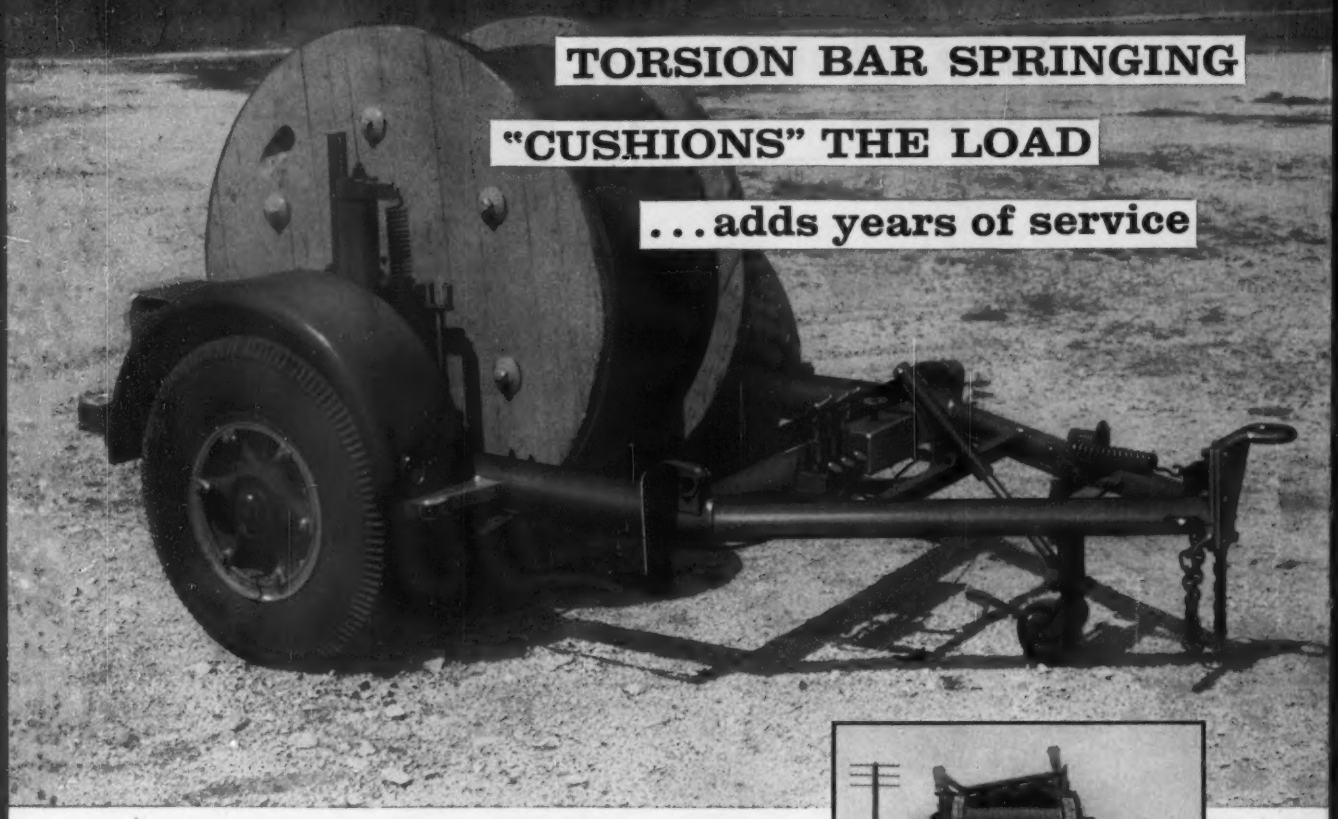
TORSION BAR SPRINGING

"CUSHIONS" THE LOAD

...adds years of service



"Cable-Master" HYDRAULIC CABLE REEL TRAILER

Usual trailer bounce over bumpy roads has been eliminated from "Cable-Master" reel trailers by a unique torsion bar spring suspension system . . . for the load, the frame and the axles. Now, torsion bars . . . not the load . . . absorb shocks of the road. This exclusive jolt-cushioning feature is standard equipment that adds many maintenance-free years to both the trailer and tires.

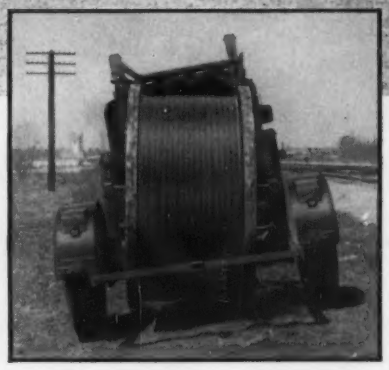
A series of hydraulic controls enable one man to quickly lift a reel weighing up to 12,000 lbs. into the trailer, and then effortlessly hook on to the towing vehicle . . . all without a winch or crane.

The front, full-swivel support wheel is power elevated to align the drawbar eye with the towing vehicle hook. The "Cable-Master" is available in capacities ranging from 8,000 to 12,000 lbs. for transporting reels up to 52" wide and 96" in diameter.

McCABE-POWERS BODY COMPANY

5900 NO. BROADWAY • ST. LOUIS 15, MO.

625 Cedar Street, BERKELEY 10, CALIF. • 1461 E. Washington Blvd., LOS ANGELES 21, CALIF. • 5525 S.E. 28th Ave., PORTLAND 2, ORE.



Independently operated hydraulic cylinders raise or lower either side of the reel to facilitate cable pay-out on uneven ground as shown above.

Another reason why
UTILITIES EXPECT MORE FROM

POWERS American

UTILITY BODIES AND EQUIPMENT

Pole Trailers:
Extra strong, electrically welded steel minimizes maintenance. Available in sizes for one to five tons with optional brakes, pole binders, lights and signals, drawbars, flag holders.

General Purpose Tool and Material Trailers:
Ideal for safely storing tools on the job site. Plywood-lined side door converts to workbench when open. Holds over 1,000 lbs.

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ELECTRICAL WORLD

Vol. 154, No. 10 September 5, 1960

Published weekly by McGraw-Hill Publishing Co., Inc., James H. McGraw (1860-1948), Founder. Executive, Editorial, Circulation and Advertising Offices: McGraw-Hill Building, 330 West 42nd Street, New York 36, N. Y. Printed at 99-129 North Broadway, Albany 1, N. Y. See panel below for information regarding subscriptions or change of address.

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Subscriptions are solicited from executive, supervisory, and engineering personnel in electric utilities, manufacturing companies, and related fields; and from consulting engineers and electrical engineers in industry. Position and company connection must be indicated on subscription orders. Send to address shown in box below.

United States and Canada subscription rate for individuals in the field of the publication $6.00 per year; single copies 50 cents. Other Western Hemisphere and the Philippines $20.00 payable in advance and other countries $30.00 payable in advance.

Second-class postage paid at Albany, N. Y. Title registered in U. S. Patent Office.

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SUBSCRIPTION AND ADDRESS CHANGES: Send subscription correspondence and change of address to Fulfillment Manager, ELECTRICAL WORLD, 330 West 42nd Street, New York 36, N. Y. Subscribers should notify Fulfillment Manager promptly of any change of address, giving old as well as new address, and including postal zone number, if any. If possible, enclose an address label from a recent issue of the magazine. Please allow one month for change to become effective.

Postmaster . . . Please send form 3579 to Electrical World, 330 W. 42nd St., New York 36, N. Y.

LETTERS

Young Japanese Engineer Needs a Hand

To the Editor:

. . . I work at Kansai Electric Power Co. Here is installing four units of 156,250 kw, 2400 psi, 1050/1000F.

. . . As my knowledge of power engineering is still very green, I am endeavoring to improve upon it. I do hope you will get some young power engineer for me to write to. I should appreciate it greatly if you would be so kind as to choose one who works at electric power company or at generating equipment maker.

First I wish to study steam generating equipment as following:

Boiler (drum, superheater, economizer, burner)
Air preheater
Draft fan (including recirculation)
Pulverizer
Dust collection.

Noboru Kimura
1143 Uematsu
Yao-City, Osaka, Japan

▶ *Here is a plea for help from a 23-year-old Japanese engineer who is faced with a difficult installation problem. We hope that young utility engineers in the US will volunteer.*

Don't Discriminate Against Utilities

To the Editor:

I have read with interest your editorial in the Aug. 1 issue entitled "Now Is the Time for Political Responsibility" and during the first few paragraphs felt that at least one voice was speaking in such a manner that was both forceful and direct.

When all of a sudden you change a direct attack to one of subterfuge with the paragraph beginning "But utilities are something else again."

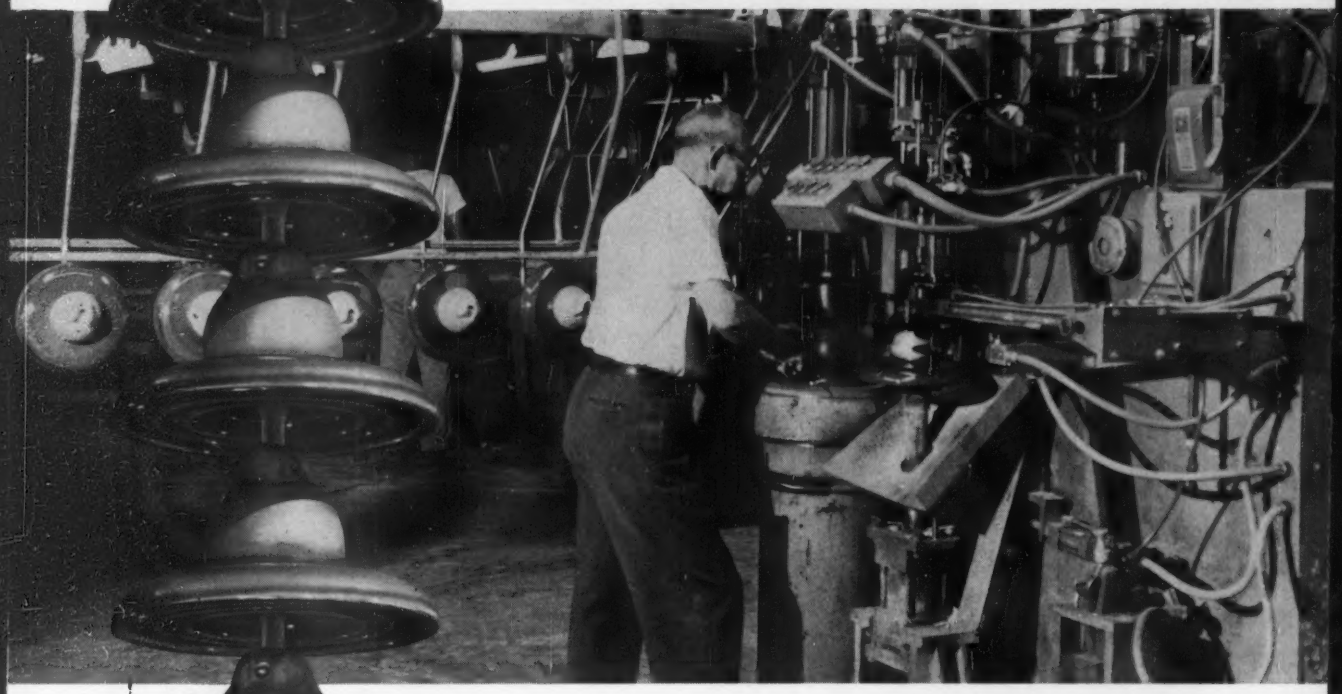
Now, sir, I ask you "Why are utilities different?" What is wrong with a "Partisan Point of View"? Why should not a private utility or any other concern for that matter voice their convictions in a straight-forward and honest manner?

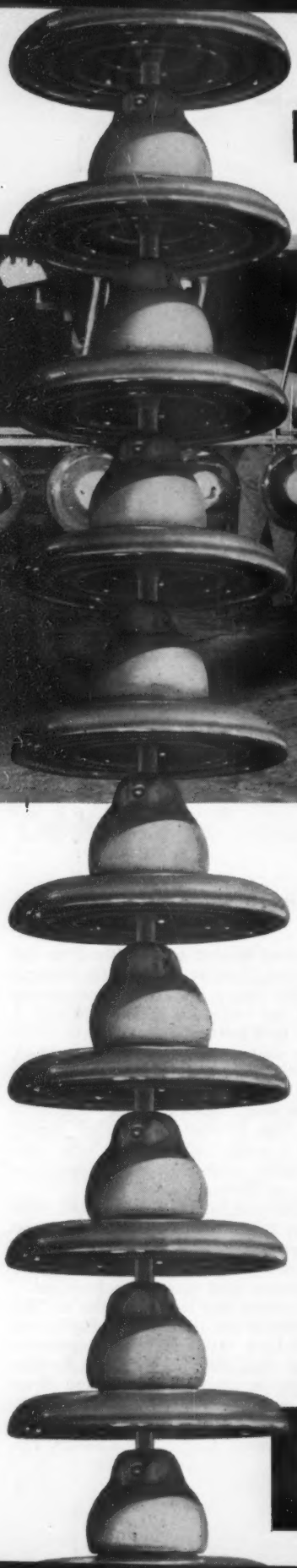
If persons, organizations, publications, etc., who are the leaders in the utility field continue to compromise their convictions, then I believe that the goals of continued independence from complete governmental controls shall become unobtainable.

Indeed, sir, I believe that the past belief in "But utilities are something else again" is erroneous and dangerous. I believe that any private enterprise has not only the right but the obligation to fight for its convictions in, again, an honest and direct manner.

A. B. Hull Jr
Tampa, Fla.

We make 'em good . . .





and we make sure!

Every single Lapp suspension insulator takes a harrowing cycle of torture tests far more severe than normal service on your lines. The machine in this picture, for example, subjects each insulator to a test pull that will rip the guts right out of any sub-strength unit.

It hardly ever happens. Here at Lapp we're automated for such tight control of production processes that it *can't* happen, except by some freak conditions.

It's all part of Lapp's program of continuous improvement. No sudden, drastic design changes—no juggling of ratings—but constant endeavor to tighten the uniformity of our insulators. Uniformity in strength, in impact resistance, in every measurable characteristic. Uniformity that pays off in the uninterrupted service you expect on Lapp-insulated lines.

Lapp Insulator Co., Inc., Le Roy, N.Y.

Lapp

You can save money on bookkeeping time with Graybar as your auxiliary warehouse

At least half of stores' transactions cover items costing under a dollar. So it's easy to see how total bookkeeping time can be topheavy.

However, when you make Graybar your auxiliary warehouse for electrical equipment and supplies, you open possibilities for savings. An increase in the number of items on the Graybar order, can save you time in writing orders and in processing them. So can the blanket order for a specified period. Other measures save at inventory and auditing time.

Start with a local call . . . Let the Graybar man come in, study your system, and submit recommendations. You'll find it worthwhile.

Employee-owned Graybar, a part of your local community, has served utilities continuously since the first lines went up. Whether you require 3 items or 3,000, Graybar is your most practical source for most electrical utility equipment and supplies.

When Graybar is your auxiliary warehouse—

- You save on storeroom costs
- Reduce inventory investment
- Insure prompt delivery
- Step up manhour efficiency
- Simplify bookkeeping

933

GraybaR

ELECTRIC COMPANY, INC.

420 Lexington Avenue, New York 17, N. Y.

Graybar Everything Electrical GraybaR Electric Company

IN OVER 130 PRINCIPAL CITIES

LOCAL SERVICE TO UTILITIES THROUGH COAST-TO-COAST WAREHOUSING

Sure, they're for the birds . . . but that's not all!

NEW SKY-BLUE COVERS

ON POLE STAR® TRANSFORMERS

prevent animal-caused outages . . . improve service continuity

Yes, the new Sky-blue Covers of Pole Star Distribution Transformers are "for the birds" in that our feathered friends—as well as other members of the wildlife community—can now make contact between transformer cover and bushing terminal without harming themselves and *without causing line-to-ground short circuits.*

Thus, Pole Star users need not go to the expense and trouble of bushing caps, terminal taping, or any of the other special methods for preventing animal-caused outages. Insulated Sky-blue Covers will be standard—at no extra cost—on all pole-type Pole Star Transformers with cover bushings.

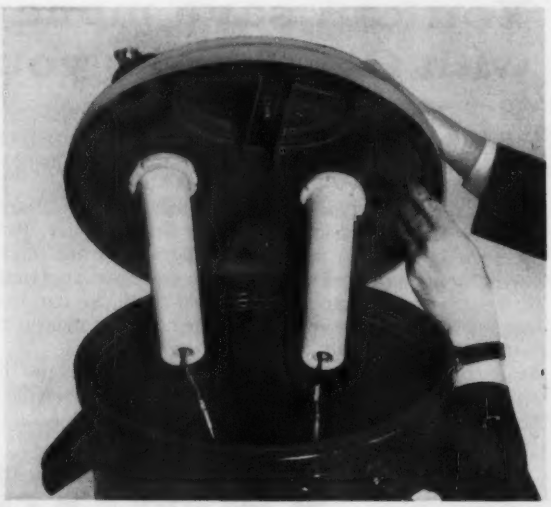
Long-lasting protection against outages is assured by the specially applied polyvinyl-chloride finish of Sky-blue Covers. Varied in thickness to provide an *extra margin* of dielectric strength in all voltage classes, the vinyl coating offers amazing resistance to corrosion. For example, after 3000 hours of exposure to salt spray, Sky-blue Covers were in better condition than uninsulated covers were after but 1000 hours.

Outstanding mechanical strength—resistance to impact and abrasion—precludes any necessity for "kid-glove" treatment during handling and installation. (See accompanying photograph of grit-blasting tests.) In the event that damage should occur, however, the sky-blue finish may be easily repaired by the user.

Easy identification of cover-insulated transformers in storage and on poles is made possible by the distinctive color of Pole Star's Sky-blue Covers. To take advantage of this "new look" and the protection it offers, contact Distribution Sales, Pennsylvania Transformer Division, McGraw-Edison Company, Canonsburg, Pa.

covers withstand grit-blasting

The operator of one of Pennsylvania's grit-blasting booths demonstrates the equipment used for subjecting Sky-blue Covers to an extremely grueling test for abrasion- and impact-resistance. Covers were bombarded with steel grit for more than three minutes *without exposing any bare metal.*



bushings are clamped internally

Sky-blue Covers have no external bushing clamps, thereby eliminating a potential dirt catcher as well as improving transformer appearance. The internal ring-clamp assures uniform pressure at all points for maximum gasketing effectiveness. Gaskets are made of nitrile rubber.

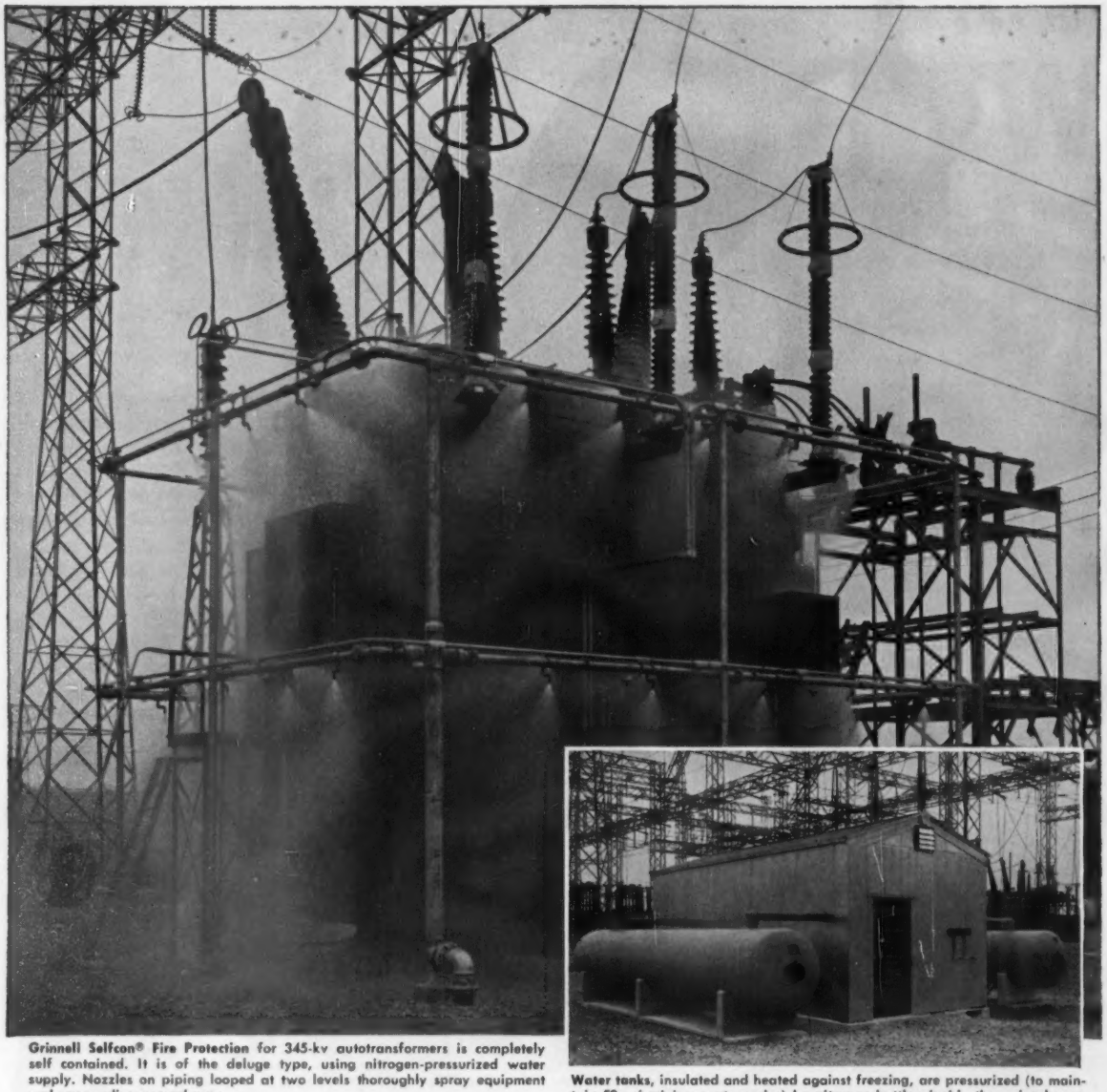
PENNSYLVANIA DISTRIBUTION

TRANSFORMERS

PENNSYLVANIA pt TRANSFORMERS

McGRAW EDISON

Live parrot, photographed by Taylor Beech, Pennsylvania Transformer staff photographer.



Grinnell Selfcon® Fire Protection for 345-kv autotransformers is completely self contained. It is of the deluge type, using nitrogen-pressurized water supply. Nozzles on piping looped at two levels thoroughly spray equipment and surrounding ground area.

Water tanks, insulated and heated against freezing, are pressurized (to maintain 50 psi minimum at nozzles) by nitrogen bottles inside the valve house.

Now you can have water spray protection against fire without public water supply

Limited water supply fire protection systems by Grinnell have been installed for transformers at two substations of a large midwestern utility. The system consists of water storage tanks and cylinders of compressed nitrogen gas, safely located out of the hazard area, and connected by piping to the water spray nozzles in the areas to be protected. Automatic fire detecting devices are connected back to the nitrogen cylinder release.

Should a fire break out, nitrogen is quickly released into the water tank, raising the pressure so that water is discharged from the spray nozzles with maximum extinguishing effect. The water capacity of the system provides a safety factor well in excess of extinguishing time.

Grinnell first introduced this type of water spray protection in America, and maintains that leadership through continuing research. An engineer from Grinnell's Fire Protection Division will gladly explain in more detail how the system works. Phone or write Grinnell Company, Providence 1, R. I. Branches in principal cities.

GRINNELL

AUTOMATIC FIRE PROTECTION SINCE 1870

¾ HOOK . . . preferred by linemen, makes it easier to engage the eye of the clamp to be removed. Extra-strong bronze ¾ hook seats deep in head casting to prevent twisting open. Note, too, how yellow color assures hi-visibility where it counts most . . . at the "business end" of the stick.

new!

KEARNEY

YELLOW FIBERGLAS CLAMPSTICK

...with enclosed mechanism...added safety features

NEW! **A shotgun stick you can always see... in any light... against any sky... in the beam of a spotlight.**

NEW! **Telltale yellow surface shows instantly if the stick is safety-clean.**

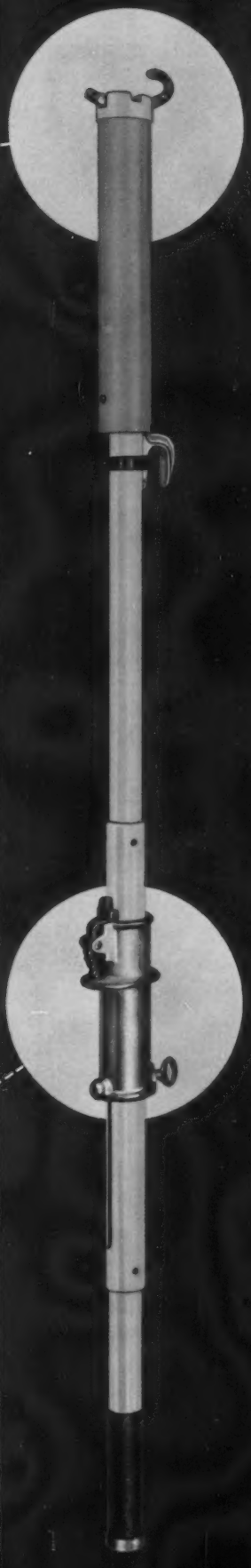
NEW! **Smooth-as-silk operation... fully enclosed operating rod and mechanism... ¾ hook... thumb latch.**

Kearney's new clampstick combines the lightness, ruggedness and high dielectric strength of a Fiberglas pole with a slick new mechanism . . . plus an important bonus . . . yellow color permanently molded-in for maximum visibility. Needs no costly refinishing.

Operating rod mechanism is fully enclosed, protected . . . prevents rod damage, eliminates rod servicing. Only 3 moving parts . . . nothing to bind, stick, get out of adjustment. Field-strips for fast, easy cleaning by removing only *one* screw. Equipped with ¾ hook . . . thumb latch, safety-lock and stop. Non-slip grip.

Yellow non-porous surface instantly shows soil, grease or dirt which might cause excessive leakage . . . wipes "safety-clean" in seconds.

Tested for 100 kv per foot for 5 minutes.
Available in 4', 6', 8', 10' and 12' lengths, one-piece or hinged.



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THUMB LATCH . . . conveniently located on aluminum operating handle. Faster, easier to use with gloves. In latched position keeps hooks open while engaging clamp eye . . . prevents accidental retraction of hook. Sharp downward pull of handle releases latch, closes hook. Safety stop prevents accidental opening of hook while clamp is engaged. A locking wing screw is also provided.

for better construction . . . safer maintenance . . . specify KEARNEY products

JAMES R. KEARNEY CORPORATION ST. LOUIS, MO.

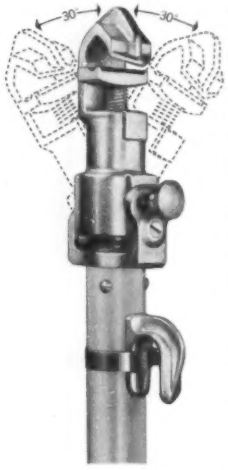
JAMES R. KEARNEY CORPORATION

4224-42 Clayton Avenue, St. Louis 10, Missouri

PLANTS AT: ST. LOUIS • FAYETTEVILLE, ARKANSAS • SHENANDOAH & CLARINDA, IOWA • GUELPH, ONTARIO, CANADA

3 Kearney products to make the lineman's job easier...safer!

ADJUSTABLE HEAD JUMPER HOLDING TOOL



Aluminum alloy head is adjustable 30-degrees either side of center . . . rigid in all positions.

Gives positive control . . . tight grip . . . easiest handling of slack conductors. Enables linemen to maintain required safety clearance when working jumpers on difficult angles. Invaluable for accurately positioning jumpers at maximum reach from pole . . . for making hot line splices and taps.

Clamping screw has smooth, no-drag drive. Yellow Fiberglas handle and plastic covered, laminated fir, clamp-screw operating rod provide maximum safety. Light weight, wide range . . . 6 solid to 336.4 MCM ACSR. Pole length 4′ or 6′.

JUMPER CLAMP

Extra-wide range accommodates the large conductors of high capacity distribution systems . . . 1,192.5 MCM ACSR or 1,300 MCM stranded to 6 solid. Jumper cables up to 4/0 15,000 volts fit in the T-bolt terminal . . . without disassembly for installation. The aluminum alloy head will carry 400 amps. Maximum safety is assured by a yellow Fiberglas handle over the plastic covered, laminated fir, clamp-screw operating rod with colored-coded, non-slip gripping area. Light weight . . . only 4 pounds.

COMPRESSION FERRULE ALUMINUM GROUNDING SETS

The only "dead" or de-energized circuit is a *grounded circuit*. Get safe cable connections . . . less weight . . . with this family of grounding clamps for *aluminum* grounding cable. Ferrules are compressed onto the cable with the WH-1 or WH-2 hydraulic tool . . . threaded into the frame . . . locked with a jam nut. Take 600 volt aluminum grounding cable up to 4/0. Single grounding clamps and 2-, 3-, or 4-clamp cluster sets available in two sizes with ranges from 8 solid to 666.6 MCM ACSR or to 2″-diameter. Jaws of flat face clamp open 1.5″.

for better construction . . . safer maintenance . . . specify KEARNEY products

JAMES R. KEARNEY CORPORATION ST. LOUIS, MO.

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PLANTS AT: ST. LOUIS • FAYETTEVILLE, ARKANSAS • SHENANDOAH & CLARINDA, IOWA • GUELPH, ONTARIO, CANADA

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The Electrical Week

LATE NEWS ▶

Asotin County (Wash.) Water Users Assn reports having more than necessary 413 signatures on petition to place the issue of forming a public utility district. Washington WP serves about 4,600 electric companies in the county.

Daytime blackout hits 8,000 customers in Con Ed's suburban N. Y. area as two 45-kv underground cables fail in 90-F heat. Circuit switching restores service to 3,000 customers in two hours. Others were out about six hours.

California Labor Federation (AFL-CIO) convention urges citizens to vote against $1,750 million state water bond proposal in November. Meetings criticized lack of protection against monopolization of benefits, allocation of costs, public power, and economic feasibility.

Portland, Ore., City Council shelves proposal by local group that city buy Pacific P&L properties in city limits. Council cites lack of money to make even preliminary study but says that acquisition proponents can use initiative procedure.

Des Moines City Council okays Iowa P&L request for special election on electric and gas franchise on Sept. 26. IPALCo move aims to clarify franchise status before bond issue later. Utility agrees to pay 1% gross electric receipts tax and 2% on gas sales.

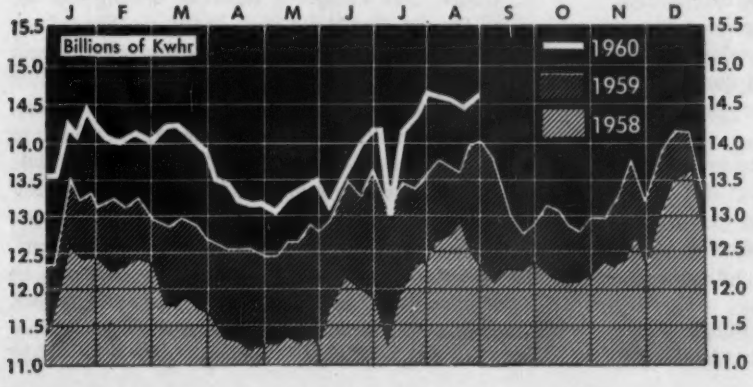
Sen Hall Lusk (D-Ore.) introduces bill to guarantee BPA area customers first call on Bonneville power. Aim is to assure area load growth against losses through PG&E's proposed purchase of BPA surplus, 500-kv California-BPA tie, or 500-kv tie to Mid-West Electric Consumer group in Missouri Valley.

GE offers its unions 3-year contract including 3% wage increase this fall, an additional 4% increase in 1962, and more liberal fringe benefits.

Burns Creek power project dies without a vote as House Interior Committee fails to muster a quorum . . . "Coordinated Operations" bill to permit increased generating capacity in river basins by coordinating streams and electric systems also dies. Bill was opposed by some public power groups, including NRECA.

Congratulations . . . Three utility executives win ASME awards. George Westinghouse Gold Medal goes to E. C. Gaston, Southern Services president. S. N. Fiala, American EP vp, and J. H. Harlow, PE chief mechanical engineer get Prime Movers Committee Award.

WEEKLY POWER OUTPUT—Up 3.5% (Week ending Aug. 27), Kwhr 14,602,000,000)



Per Cent Change From Previous Year

	Aug. 13	Aug. 20	Aug. 27
Total U. S.	+ 7.1	+ 3.2	+ 3.5
New Eng.	+ 7.1	− 0.3	+ 2.3
Mid. Atlan.	+ 5.0	− 3.8	− 0.4
Cent. Ind.	+ 6.5	+ 3.1	+ 1.5
West Cent.	+ 8.9	+ 1.3	+ 0.8
Southeast	+ 7.2	+ 3.7	+ 0.7
South Cent.	+ 9.3	+ 1.5	+12.0
Rocky Mount	+11.8	+15.3	+15.1
Pacific			
NW	+ 4.5	+ 5.7	+ 9.0
SW	+ 9.3	+14.2	+ 8.0

Seasonally Adjusted Index 268.9

Week Ago 264.6 Year Ago 259.8

Source: Edison Electric Institute

Preview of This Issue

EVENTS ▶ **How will the utilities' friends and foes in Congress fare** in the November elections? Several private power supporters face tough fights; some strong public power supporters look like "shoo-ins." For an early forecast, see **page 26** . . . California irrigation districts look askance at 500-kv Bonneville-California tie as threat to economic feasibility of in-state water projects **(p 30)** . . . Co-op plans for new generation and hassles over rates stir new disputes in Mississippi, Oklahoma, and Illinois **(p 29)** . . . Trial of antitrust case on power switchgear assemblies is postponed until Oct. 31 because of docket conflict **(p 28).**

ENGINEERING ▶ **Intensified need for careful selection of relays** is result of evolution of higher-voltage network systems. Two variations of protectors—one employing a 460-v relay the other a 216-v one—can be used in the new systems **(p 32).**

Radioactive probes measure coal-pile density and moisture in standardized method of taking inventory of steam-electric plant's coal on hand **(p 34)** . . . Computer speeds 10-year load growth projection and plans new substation capacity to meet anticipated load growth. Use of the computer increases calculation speed and accuracy, and produces easily-interpreted results **(p 39).**

PROCUREMENT & PRODUCTS ▶ **Second power capacitors price increase** comes with GE's 4% hike on 50 and 100-kvar units . . . GE-IUE dispute may be settled without a strike **(p 50).**

Manufacturers News: Two new entries appear in the field of peaking standby

Politics and Public Power

Showdown Looms for Nez Perce

One of Washington's most drawn out battles is going into the crucial round. We refer to the rival plans of investor-owned utilities and public power groups to build a high dam on Middle Snake River.

And it seems that the Federal Power Commission, not Congress or the White House, will render the decision. Politicians have played with High Mountain Sheep, high Hell's Canyon and Nez Perce as political labels for at least a decade. But the political divisions in the House and Senate make it almost impossible for a decision to be made on Capitol Hill for private or public development.

The new round began Sept. 2, and final decision is perhaps a bit more than a year away.

The conflicting plans are:

(1) Pacific Northwest Power Co's to build a high (670-ft) dam at High Mountain Sheep site on the Snake, just above the confluence of the Salmon River. This dam would hold back 3.6-million acre-ft of water, have a 1.75-million-kw ultimate generating capacity, cost $187.2-million.

(2) A plan of the Washington Public Power Supply System to build a high (700-ft) dam at Nez Perce site, just below the confluence of the Snake and Salmon. This dam would hold back 6.6-million acre-ft of water, have a 3.36-million-kw ultimate generating capacity, cost $412-million.

Hearings first were set last March 21 for the PNP project, but an 11th-hour filing by rival Nez Perce proponents delayed FPC consideration of High Mountain Sheep until the projects could be considered together. Hearings again were set for July 18, but later postponed, at Washington Public Power's request, until October 17.

Under a new legal procedure—set up by the FPC for the Nez Perce-High Mountain Sheep case —FPC has ordered a simultaneous filing of all direct testimony and exhibits seven weeks before the actual hearing limited to cross-examination gets under way. This gives each party, and intervenors, time to study each other's evidence and eliminates possible favoritism if one rival party were required to present its direct case orally ahead of the other.

On Sept. 2, when both parties filed direct testimony, Washington Public System came up with new and "complete" cost estimates for its proposed project, including fish facilities and interest during construction, of $412-million. Washington Public revealed

power units: 2,000-kw diesel-powered, quick-start generator sets and self-contained, automatically-controlled gas-turbine plants in 3,000, 7,000, and 12,000-kw ratings . . . Gas turbine shipped to Austin, Minn., will ultimately be part of combined steam-gas cycle to increase thermal efficiency **(p 52).**

New Equipment: Advantages of single and 3-phase voltage regulators are combined in one unit . . . Acrylic plastic spacer is weather and track-resistant, and has low leakage and corona levels in wet weather **(p 60).**

MANAGEMENT ▶ **Equipment alone cannot meet the challenge of increasing power demands.** Recognizing this, Con Edison institutes a cadet training program designed to form an elite group to shape their own and the company's future **(p 37).**

This isn't the first time the manufacturers have had headaches. A look into this problem and the antitrust actions is the first of three articles **(p 65).**

SELLING ▶ **Thar's gold in them thar promotion campaigns!** So declare "assayers" in Cincinnati G&E's gimmick gold—or "cold"—rush which ties prospecting for gold into refrigerator-freezer publicity **(p 71).**

NEXT WEEK ▶ **Six-page Canadian utilities roundup** is presented by roving editor Len Olmsted.

also that it had increased both the initial (2.1-million-kw) and ultimate (3.36-million-kw) generating capacity at its project because of **(1)** a rise in the dam elevation from 1,490 to 1,510 ft, and **(2)** increased efficiency of larger proposed turbine units.

Washington Public also proposes a small dam upstream on the Salmon at the White Bird site to use up a small remaining amount of head on that river. This small dam will be part of the downstream migratory fish facility, but eventually would have a 70,000-kw generating unit added to it.

Next step in the legal procedure will be filing—on Sept. 19—of briefs and exhibits by the FPC staff and all intervenors. The position of the FPC staff is undisclosed. Most intervenors are fish and conservation groups—either local or state—who are concerned over possible damage to salmon runs by the large dams. Most of these groups are worried primarily over the Nez Perce project because it would block fish runs up the Salmon river; High Mountain Sheep would not.

The Nez Perce backers, in a remarkably few months, have come up with a new design for fish passages—both up and down stream—which they claim will satisfy conservation groups. High Mountain Sheep also has a novel fish facility, but the conservation pressure is aimed mostly at Nez Perce.

Intervenors include the Northwest Public Power Association, and National Hells Canyon Association.

After both applicants and all intervenors and FPC staff have filed their testimony, a pre-hearing conference will be held Oct. 5 to resolve procedural steps to make hearings run smoothly.

Hearings, limited to cross-examination, begin Oct. 17, when the fireworks will begin. As both parties and intervenors will have had many weeks to review rival testimony, they should be prepared to challenge each other's claims in detail.

During this phase of the case, PNP is expected to challenge Washington Public System's application on two grounds: **(1)** Whether the system legally can file on a project outside its chartered state of Washington, **(2)** Whether the system has proved adequate financial backing and markets.

Barring any unexpected turns, cross-examination should be completed by early 1961, leading the way to an examiner's intermediate decision—probably to be waived to save time—and then the final oral argument and order by the full Commission.

Nuclear Notes

AEC's withdrawal of its contract with General Electric (EW, Aug 29, p 15) for the improved-cycle boiling-water reactor came after officials ot rival bidder Allis-Chalmers said that they believed their bid to be $1 million less than GE's and that perhaps the Commission's contract selection board erred in arithmetic when calculating the low bid for the contract. The Commissioners have agreed to review the bids for its reactor, which will furnish steam to turbine-generators to be installed jointly by the power departments of the cities of Los Angeles and Pasadena.

The typical state utilities commission "will in all probability continue to approve the expenditure of reasonable sums to keep utility personnel adequately abreast of developments in nuclear power plants and to recognize such expenditures for rate-making purposes." This is the conclusion of Cal Tech's Dr Ray E. Untereiner in his report, "State Regulation and the Future of Nuclear Power," written for the Atomic Energy Commission. The report, just out, is based largely on the responses of 37 state commissions to a questionnaire, in which "commissioners and their staff experts were asked to disclose in advance the decisions they would be inclined to reach on important questions that may eventually come before them." The 11-page report is available for 50¢ from the Office of Technical Services, Dept of Commerce, Washington 25, D. C.

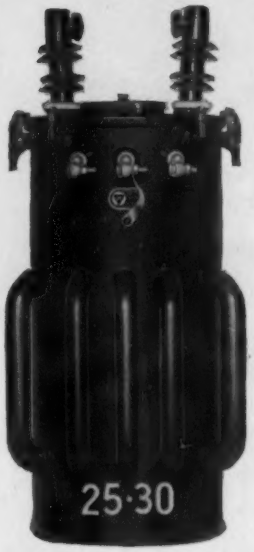
Vallecitos, Calif., boiling-water reactor recently went critical again after ten months of shutdown for a million dollars worth of modifications. The present core holds fuel assemblies for several AEC programs, including fuel elements for the Big Rock Point, Mich., BWR. Work during conversion indicated that radioactivity will not be a serious problem in the maintenance of this type reactor. Radiation levels in the reactor building, except in the area formerly occupied by the reactor core, were low enough to permit crews to work full shifts with easily controlled safety precautions. The GE test reactor operated 26 months before shutdown.

Research and development costs for British power reactors have been running about 30% of the capital value of plant, while those for conventional plants are near 5%, Sir Christopher Hinton, chairman of the Central Electricity Generating Board, said in a recent address. He suggested setting as an end date to such a high R&D cost for nuclear plants the time, estimated as arriving in the 1970's, when nuclear and conventional power costs become equal. After that, research costs should be self-limiting to those economically justified by industrial applications.

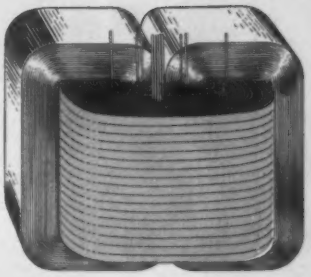
Thermoelectric conversion device, SNAP 10, has been tested successfully by its builder, Atomics International. Heat from U^{235} fuel, mixed homogeneously with zirconium hydride moderator, generates electricity in thermocouples, which surround the core. The developers expect 300 w from the unit, whose core is about 1/5 cu ft in volume.

India's government has chosen a site for its first atomic power station. The 300-Mw plant will go in near Tarapore on the west coast north of Bombay. The site, near load centers, was chosen with an eye to health and safety.

The international Halden reactor project in Norway has been extended for a year and a half. This will make the total program last 4½ years and cost $6 million. The experimental boiling-heavy-water reactor, an OEEC project, went critical in June 1959, but is at present shut down.



L-M transformers exclusively incorporate a core-type core-and-coil design, designated Round-Wound®. It is a continuously wound single core with coils wound directly on each leg. This exclusive design, illustrated by the color area, permits oil ducts to be concentric about the entire winding. Maximum winding area is exposed to oil for rapid and efficient cooling. For any given loading, Round-Wound transformers have considerably lower hottest-spot temperatures and therefore greater life expectancy.



Every major manufacturer of competitive transformers utilizes a shell-type core-and-coil design. Oil ducts, illustrated by color area, can not be placed in the portion of winding under the cores. Heat is trapped and hottest-spot temperatures build up. Circulating oil can not get to these spots to carry the heat away. Result: oil stays fairly cool, while windings sizzle. Insulation deteriorates most rapidly in these areas, with an appreciable reduction in transformer life.

Uprate L-M Round-Wound® Transformers Without Any Loss of Life Expectancy

All L-M Round-Wound transformers, serial number 1,700,000 or above (serial number 7,006,650, Visalia, California production), can be safely uprated. This uprating applies to transformers now in service or in your stocks. It includes all L-M transformers produced within the last 2½ years. Only L-M can safely offer this unprecedented uprating because of the exceptional cooling characteristics of the Round-Wound core-coil construction. You get the following bonus uprating on Round-Wound transformers:

20% bonus: 5-15 kva, through 16,340 volts
20% bonus: 25 kva, through 8,000 volts
12% bonus: 25 kva, 12,000 through 16,340 volts
12% bonus: 37½-100 kva, through 16,340 volts
5% bonus: 167 kva, through 16,340 volts

Increased transformer loading and decreased transformer life expectancy are closely related. As over-loading increases, transformer insulation breaks down, jeopardizing transformer life expectancy.

Average winding temperature can be partly indicative of the damaging effects loading has upon transformers. Hottest-spot temperature, however, the maximum temperature within a transformer winding, is the one sure indicator of potential winding failure. If the hottest-spot or maximum winding temperatures are held within safe limits, winding insulation is not jeopardized and normal transformer life expectancy is maintained.

Only the Line Material exclusive Round-Wound design can effectively cool the entire winding, eliminating extreme hottest-spots. Round-Wound core and coils have concentric cooling. The oil is free to circulate through the entire winding. There are no cramped areas, no extreme hottest-spots in Round-Wound design. That is why Round-Wound transformers, without re-design, can confidently be uprated —higher than any competitive design.

You can uprate Round-Wounds without exceeding the present ASA-NEMA standard of 65°C allowable maximum rise in winding hottest-spot temperature. And the uprated transformers carry the full L-M transformer guarantee.

The present design of Round-Wound transformers have been in production for over two years. Thus, the Round-Wounds on your system, in your warehouse, as well as those you buy tomorrow, have bonus capacity and may be confidently uprated.

See your L-M Field Engineer. Let him present all the logical evidence. Then . . . YOU BE THE JUDGE.

You BE THE JUDGE!

- This is one of a series of advertisements in which Line Material is presenting facts on distribution transformers.
- In other advertisements, and through calls by our Field Engineers, L-M will present additional evidence for your consideration.
- All we ask is that you listen to the facts, and weigh the evidence.
- Then YOU BE THE JUDGE of the real values in distribution transformers.

LINE MATERIAL® Industries *Transformers*

McGRAW-EDISON COMPANY

476

DISTRIBUTION TRANSFORMERS • RECLOSERS, SECTIONALIZERS AND OIL SWITCHES • FUSE CUTOUTS AND FUSE LINKS
LIGHTNING ARRESTERS • POWER SWITCHING EQUIPMENT • PACKAGED SUBSTATIONS • CAPACITORS • REGULATORS
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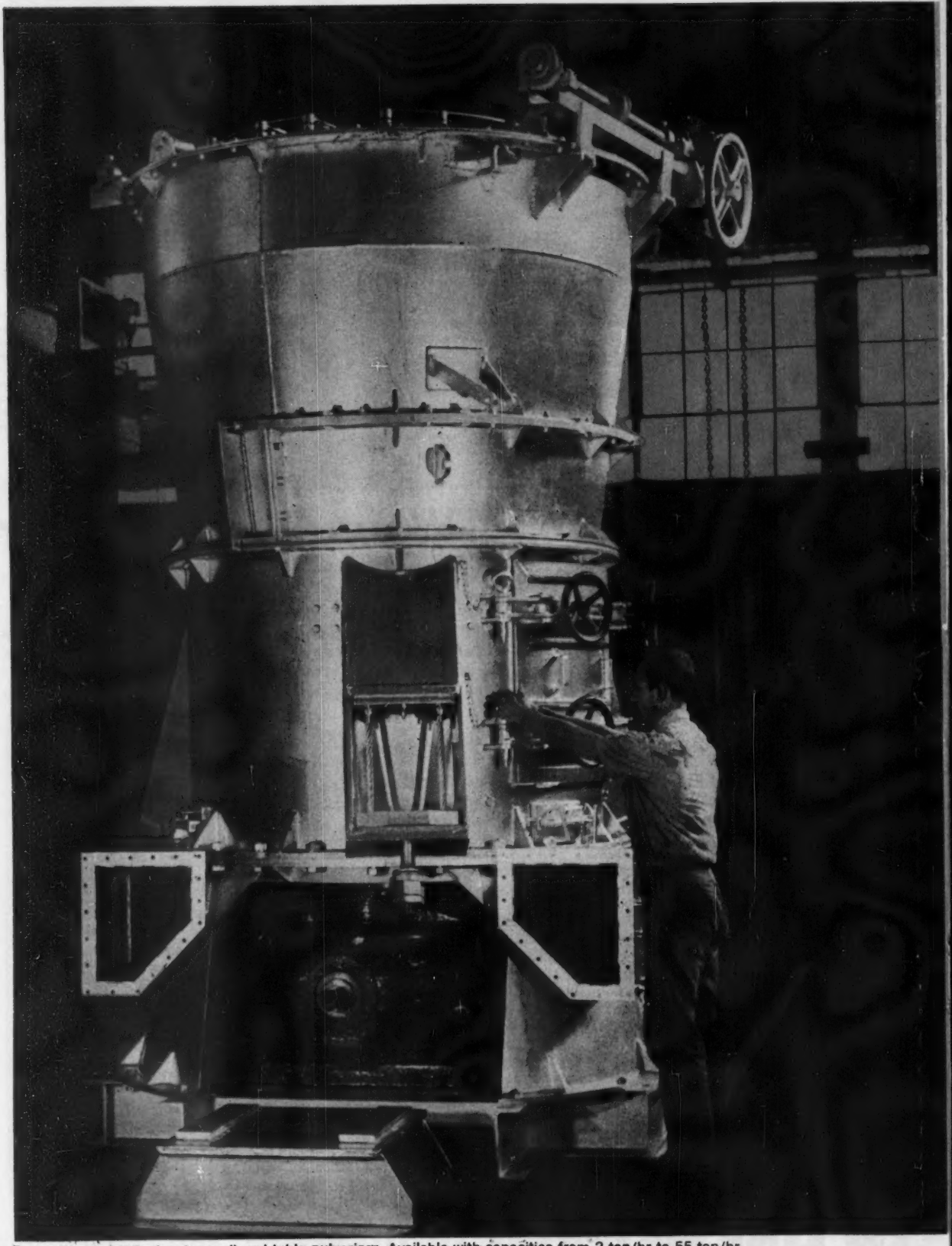
McGRAW EDISON



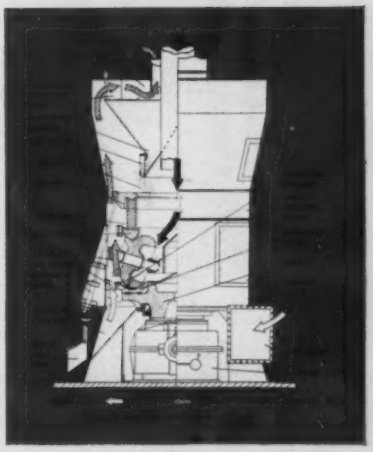
Foster Wheeler MB planetary roll and table pulverizer. Available with capacities from 2 ton/hr to 55 ton/hr.

Foster Wheeler MB Pulverizer, SIMPLE...VERSATILE...RELIABLE

The best combination of advantages for a wide range of fuel requirements

COMPARISON: Foster Wheeler MB pulverizer compared with two other leading pulverizers (A & B) available in U.S.

Power consumption	equal to A & B
Availability	better than A, equal to B
Accessibility	better than A & B
Floor Space	equal to A & B
Flexibility for suction or pressure operation	equal to A, better than B



European power companies have used the MB pulverizer for over 10 years. Low power consumption, low maintenance and the extremely high availability of the design are thoroughly proven.

Now further refined by FW engineers, and tested for two years in the U.S., the MB pulverizer deserves careful consideration in planning any fuel system which may require mill capacities from 2 to 55 tons of pulverized fuel per hour.

The MB design is extremely simple, providing reliability and ease of maintenance. The only moving parts inside the grinding area are three spheroidal rollers, a roller guide, and the powered horizontal grinding table. All adjustments can be made with the mill in operation.

The planetary motion of the rollers maintains uniform product fineness. Wear of grinding surfaces is extremely slow. The rollers and carrier need no lubrication. Noise and vibration levels are very low.

Provision is made for either pressurized or suction operation. In addition to coal pulverizing, the MB mill is also available for grinding gypsum, cement, solid chemicals, pigments, food products and other commercial materials.

Write for Bulletin MB-58-1, giving more detailed specifications for the MB mill. Foster Wheeler Corporation, 666 Fifth Avenue, New York 19, N. Y.

FOSTER WHEELER

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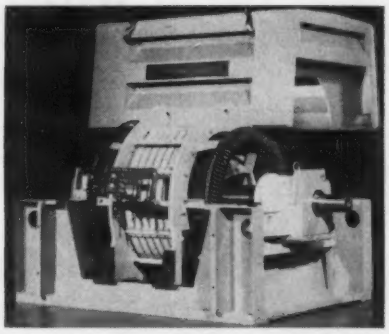
More Value For Your Large Motor Investment . . .

Westinghouse F/A design significantly

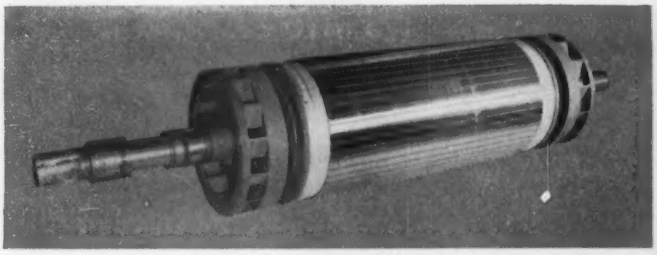
Because of their inherent design (see features below), F/A Motors greatly reduce nerve-jarring, fatiguing, high-speed large-motor noise in your plant or powerhouse . . . paying off in better working conditions and higher employe efficiency and morale.

It has been proved that quieter working environments tend to increase productivity per dollar of operating expense. Under rigid tests, Westinghouse F/A Motors show a truly significant reduction in noise levels over conventional large motors. Considering this, plus the many other F/A bonus values, you can readily see why you get more total value for your large motor investment with Westinghouse.

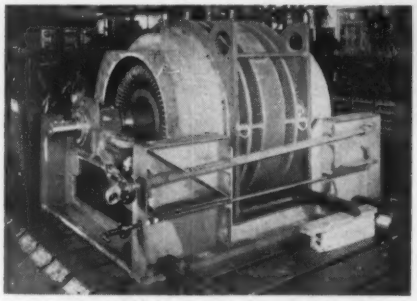
Other F/A bonus values—Besides quiet operation, the Westinghouse F/A Motor gives



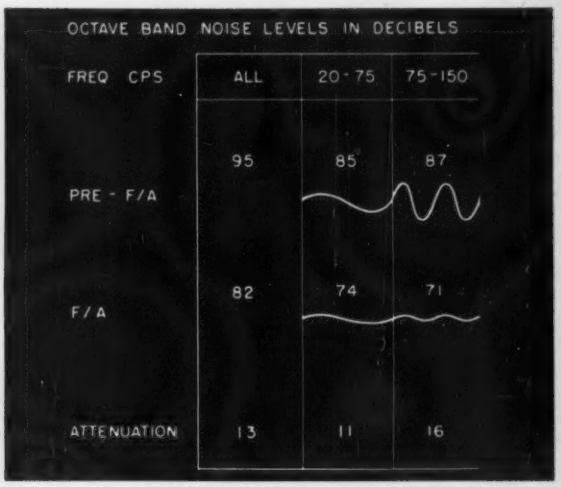
All enclosure parts are supported by the motor base, not from the frame or rotor where noise and vibration originate.



Spun aluminum shields cover the rotor cage winding ends, eliminating the siren-like whine caused by air rushing between the bars.



Heavy, massive, two-pole stator assembly minimizes low frequency noise.



Less noise: This chart shows clearly the reduction in noise output typical of the results obtained by hundreds of tests of the F/A design, as compared to previous designs. The entire range of cycles per second, and their attendant decibel readings shown here, prove this superiority of the F/A design.

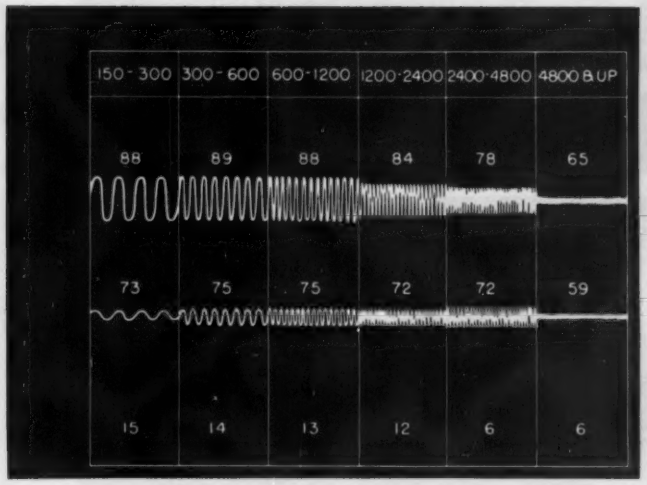
reduces motor noise in all sizes and speeds

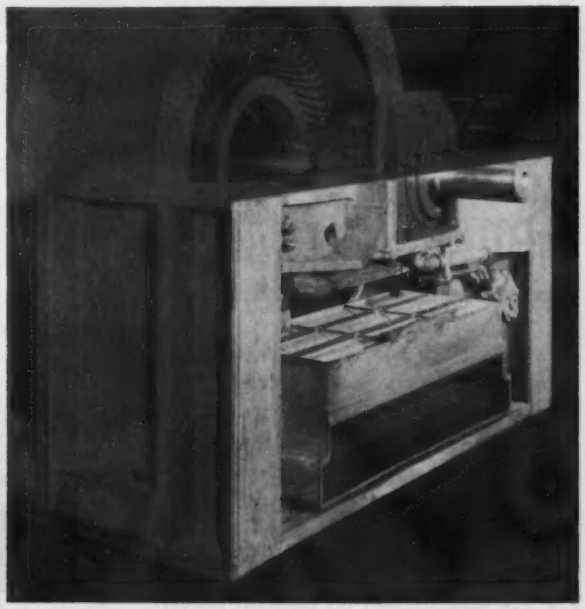
you more value for your large motor investment with these cost-saving advantages:

Super reliability—Thermalastic® insulation withstands the stresses which cause ordinary insulations to fail. F/A Motors have the time-proved stator, rotor and bearings which have set records for long, trouble-free service life.

Low maintenance—The F/A Motor housing design makes inspection easy and fast. Maintenance is now a matter of minutes. Costs in time and man power have been lowered as much as 75%.

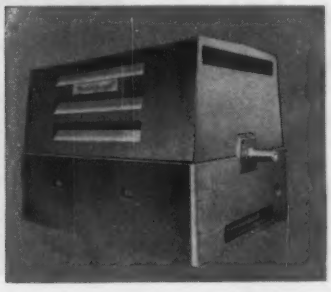
There's a Westinghouse F/A Motor to fill all your large motor needs. For more information, call your Westinghouse representative, or write Westinghouse Electric Corporation, P.O. Box 868, Pittsburgh 30, Pennsylvania. You can be sure . . . if it's Westinghouse. J-15019





Noise mufflers, above, can be easily and economically applied to air openings, even after the F/A Motor is on the line. These mufflers have little air resistance, high noise attenuation, and require practically no maintenance.

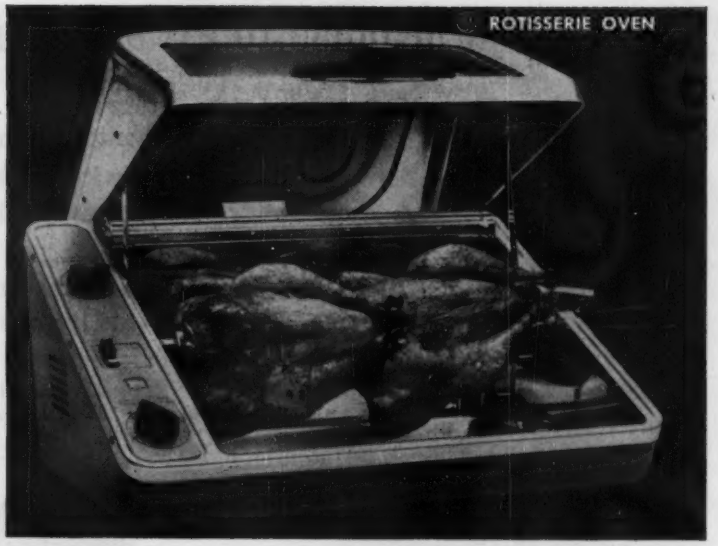
Special design—smooth surfaces plus carefully directed air flow and favorable air passages—lowers noise levels.

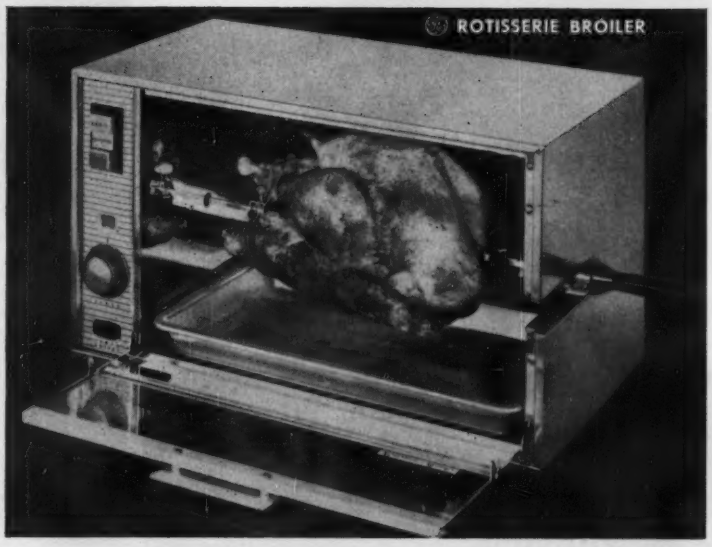


Westinghouse

Every one of these General Electric appliances sold adds an average of $7.09 a year to utility revenue.

3 big load-builders from General Electric





Now—General Electric Rotisseries and Broilers cover the entire popular price range . . . offer additional opportunities to build year-round revenues.

- All three appliances use 1500 watts
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- Retail price range—$24.95 to $89.95*

For full information on General Electric programs for increasing power use, write to General Electric Company—1285 Boston Avenue, Bridgeport 2, Connecticut. Attention: Portable Appliance Department, Merchandising Section 22CE.

*Manufacturer's suggested retail price.

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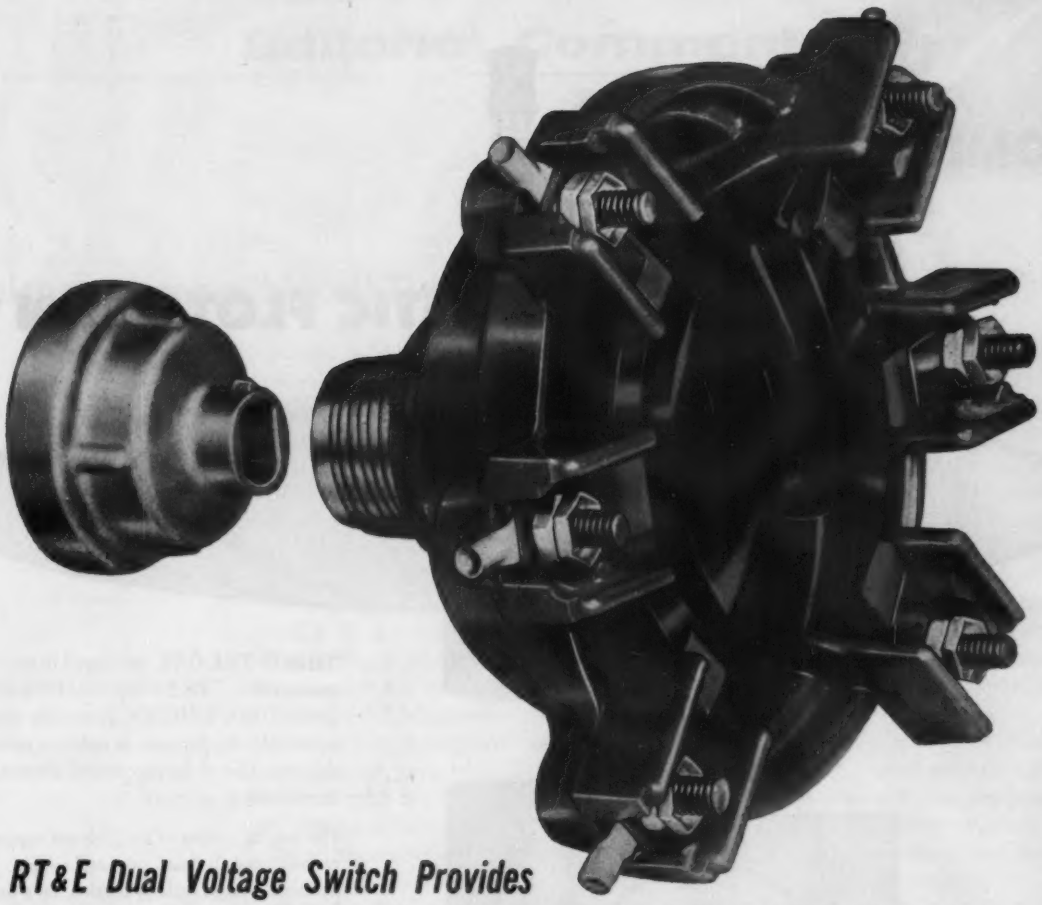
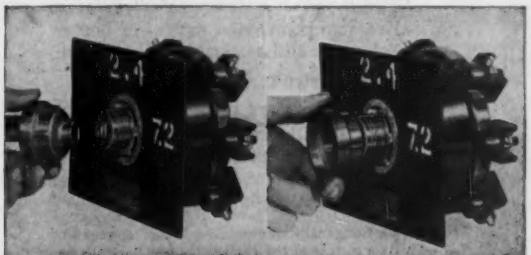
GENERAL ELECTRIC



New RT&E Dual Voltage Switch Provides

FOOLPROOF OPERATION

You cannot operate this improved RT&E dual voltage switch incorrectly. It can be moved only with the keyed handle provided, and the switch must be correctly positioned before the handle can be removed. This successor to the industry's first externally-operated dual voltage switch demonstrates further proof of RT&E's four years of dual voltage experience. Improvements include a new body of shatterproof polyester glass, dimensionally, chemically, and thermally stable, and new spring-loaded contacts that assure constant positive contact pressure. In addition, this single switch handles both even and odd multiple voltages. Plan to uprate your system now, with RT&E dual voltage equipment — transformers with more built-in experience.



SAFE! Unique keying action between handle and slotted ring around shaft assures positive positioning before handle can be removed.

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ENGINEERING TALENT CONCENTRATED ON ONE IDEA
A BETTER TRANSFORMER

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COMING YOUR WAY

the Sangamo J3, the only meter with.....

TRUE MAGNETIC FLOTATION

THIS IS THE ONE, developed to meet your needs... THE SANGAMO SINGLEPHASE J3 WATTHOUR METER. This is the new and noteworthy development in watthour meters this year. One of the exceptional advances in metering in any year!

The moving system of the J3 is not supported or suspended. It floats, pure and simple, permanently and without friction, on a field created by magnets that are dimensionally and magnetically uniform. Stability is assured by the use of specially bonded Alnico in *all* magnetic components of the system.
And, the J3 has these other *new* features:

A VISIBLE, SELF-CLEANING GAP that cannot be bridged by metal particles.

A CONTROLLED FLOATING SYSTEM for best performance on high loads. Side thrust is substantially reduced; tilt error is insignificant. These features combined with the unique slow speed of Sangamo J Meters, give you a moving system that is *guaranteed for life.*

ADVANCED INSULATION LEVEL for better protection and easier heat dissipation.

SMALLEST SIZE for easiest handling.

PLUS THESE TRADITIONAL SANGAMO ADVANTAGES: highest torque; slowest speed; lowest watt loss; sectionalized construction; corrosion-resistant finishes and materials; glaskyd base.

Your Sangamo Representative is coming your way with a sample of the J3. Become familiar with its "pluses". Then, plan to put it to work... for it has everything you want in a watthour meter. And that's a promise, for this is one of the really great ones.

JM60-4

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SANGAMO ELECTRIC COMPANY / SPRINGFIELD, ILL.

Editorial Comment

SEPTEMBER 5, 1960

Welcome Yankee! Well Done!

Today, as we write this, Yankee Atomic Electric Co Plant is going quietly through its initial low-power shakedown tests at Rowe, Mass., having gone critical on August 19, well ahead of schedule.

In characteristic New England fashion Yankee has been built without much fuss a d fanfare. Yet this reactor is the largest and the most advanced of the pressurized water cooled and moderated reactors so far built. And it incorporates fuel element and control features that are expected to provide important new technical and economic data that will speed the day when nuclear power is economically competitive.

Yankee is the second investor-owned commercial atomic power plant to begin operation in this country and the first to be built under the Atomic Energy Commission's Power Reactor Development Program. Financing of the entire $57 million required for its construction and startup was arranged by an organization of ten New England power companies.

Miraculously it looks like they raised more money than they will need! Construction costs have been consistently lower than estimated, and there are signs that final costs for Yankee may not only be lower than expected but the plant itself will generate somewhat more than its specified 134-Mw full power capacity.

On all counts what has been done at Yankee is a major achievement—for New England, for the designers, the builders, and the investor-owned utilities.

Welcome Yankee! Well done!

Prices and the Antitrust Actions – An Analysis

Two months from now, barring a delay, the government will begin trying the first of 18 criminal antitrust cases brought against the electrical manufacturing industry. At the same time, the manufacturing industry will be making further attempts to bail itself out of a price war that has been raging in many quarters for months.

We acknowledge that the problems of the manufacturers are not theirs alone. The utilities have a stake in them also. Sound and progressive relations between buyers and sellers play a part in insuring sound and progressive utility systems.

With this in mind, we present in this issue the first of three consecutive Management Newsletters on the antitrust actions and the prices. Through these Newsletters we desire to help clarify the situation by placing it in economic and historical perspective and by bringing readers what insights we have gathered after many hours of talk with utility and manufacturing executives.

Early forecasts give these Senators and Congressmen a better-than-even chance . . .

KERR

ANDERSON

SAYLOR

How Will Congressional Elections

Several conservative candidates will have a tough struggle, while many public power supporters look like winners

Issues that involve all or large parts of the utility industry may be determined by regional power issues in November's election. Although there is no sharp national split over electric power at the moment, the effect of these local contests on Congressional committee make-up and leadership in the next Congress could be critical in many crucial power questions.

Many sharp power issues of the current Administration, such as the Tennessee Valley bond issue, have been resolved for the time being. On others, the candidates are not arguing much.

On Rural Electrification Administration loans and interest rates, candidates who want a tighter rein on the agency are not playing up their position.

National Water Resource Development won't get much opposition. Opposition to some of its federal hydro power implications will be drowned by the broader water development program which is politically hard to oppose.

In the Pacific Northwest, of course, power issues are among the most important. This area will hear discussions on the Eisenhower limited "new starts" policies and on questioned operation of the Bonneville Power Administration over the past eight years—including proposals for high-voltage interconnections with California and with the Missouri basin, and the late Sen Richard Neuberger's (D-Ore.) Bonneville Power Corporation.

In the Senate races out west, here's the early campaign outlook:

Oregon—Mrs Maurine Neuberger, widow of the late Democratic senator is given the edge over her Republican rival, former GOP Gov Elmo Smith. Incumbent Sen Hall Lusk (D) was appointed for the rest of the term vacated by Richard Neuberger, and isn't a candidate for election to a full term.

Mrs Neuberger is strong for public power development. If elected, she plans to continue the fight for creation of the Bonneville Power Corporation bill, which would set up a weak "valley type" federal power marketing agency in the Columbia Basin, including the power to issue up to $1.1-billion in revenue bonds and creation of a board of directors. It isn't known whether she will continue the fight for her husband's controversial plan to modify the existing BPA preference clause to prevent any unfair geographical distribution of federal power.

Wyoming—Rep Keith Thomson, a middle-of-the-road Republican, seems to have the edge on his Democratic rival, Raymond Whitaker, for the seat of retiring Sen Joseph O'Mahoney (D).

Montana—Rep Lee Metcalf (D-Mont.) is given the edge over former Republican Rep Orvin Fjare. Metcalf beat his fellow Democratic colleague, Rep Leroy Anderson, in the state primary earlier this summer, partially on the issue of the "Headwater Benefits" Bill (HR-7201) which would permit coordinated hydro and power operations in river basins. Metcalf favored it, Anderson opposed it. The issue is favored by more pro-private advocates than pro-public supporters, but Metcalf, strongly pro-public power himself, crossed over the line on the particular bill. HR-7201 was voted out of the House Commerce Committee this year, but has been tabled on the House floor without action this year. Metcalf and Fjare are fighting over the seat of retiring Sen James Murray (D), long-time powerful pro-federal power chairman of the Senate Interior Committee.

New Mexico—Democratic Sen Clinton Anderson, the strong, pro-federal power chairman of the Joint Atomic Energy Committee, is certain of his re-election in his contest with GOP condidate William Cowles.

Nebraska—Sen Carl Curtis, a

These candidates face tough or crucial fights in November elections . . .

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middle-of-the-road Republican, seems sure of re-election against Democrat Ralph Brooks. The Nebraska incumbent voted against the Hells Canyon and Niagara power projects, voted for the TVA bond bill and for the Humphrey-Price bill to "free" the REA administrator from "political interference" in his loan making power by Agriculture Secretary Benson.

Idaho—Republican Sen Henry Dworshak, the "Idaho tradition," as one observer calls him, should win over his Democrat rival, Robert McLaughlin. Dworshak is classed as a conservative.

Colorado—Sen Gordon Allott, a conservative Republican who supports federal reclamation projects, probably will win re-election in a very close race with Democrat Robert Knous, former Colorado lieutenant governor.

Oklahoma—Sen Robert S. Kerr (D), powerful member of the Senate Public Works Committee and chairman of the Senate Select Committee on Water Resources, seems certain of election to his third Senate term in nominally Democratic Oklahoma. His GOP opponent, Tulsa Attorney Hayden Crawford, may make a better-than-usual showing against Kerr, but this will not involve power issues.

South Dakota—Sen Karl Mundt, a middle-of-the-road Republican, faces a close, possibly fatal race against Democratic Gov George McGovern. The National Rural Electric Co-op Association notes possible anti-Mundt sentiment among South Dakota co-ops over exclusion of a favorable REA plank in the State Republican platform.

Here's how some of the key House races in the West look:

Idaho—Rep Gracie Pfost, pro-federal power Democrat, should win an easy victory over her GOP apponent, Thomas Leupp. Mrs Pfost is a backer of the controversial Burns Creek project.

Colorado—Rep Edgar Chenoweth, a Republican moderate, appears to be in trouble in his November bid for re-election. Chenoweth is a member of the House Interior Committee, has been a strong supporter of the proposed Fryingpan-Arkansas project straddling the continental divide in Colorado. Rep Wayne Aspinall, a Democrat and chairman of the important House Interior Committee, is certain of re-election.

Texas—Rep Walter Rogers, Conservative chairman of the House Interior Subcommittee on Reclamation, has no GOP opposition.

California—Rep Chet Holifield, the Democratic, pro-federal power advocate for atomic power development, should win easily over Republican Gordon McWilliams. Rep Edgar Hiestand, Republican and long-time fighter against REA expansion, faces a fierce, possibly fatal campaign against Democrat Mrs Rudd Brown.

Washington—Several Republicans in the State are in trouble, but Democratic candidates won't be

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picked until the Sept. 13 primary. GOP congressmen reportedly in danger, or in probably close races, include Jack Westland, Catherine May, Walt Horan and Thor Tollefsen. Rep Don Magnuson (D-Wash.) has been listed as in a close race also. The seat of the late GOP Rep Russell Mack is a toss-up.

In the South and East, power figures in particular races, but it is not as pervasive an issue as it is throughout the West. Here is how some of the more prominent contests shape up:

Sen Estes Kefauver (D-Tenn.)—The Tennessee senator trounced a well-known Democratic candidate (Judge Andrew "Tip" Taylor) in the Democratic primary this summer. His Republican opponent this fall, A. Bradley Frazier, isn't expected to do as well as Taylor.

Sen. John Sherman Cooper (R-Ky.), a liberal Republican who supports TVA, is fairly sure of re-election this fall, although his Democratic opponent Former Kentucky Governor Keen Johnson, could give him trouble.

Rep Charles Halleck (R-Ind.)—The strongly conservative House Minority Leader has been listed, also, as in possible trouble because his position as Republican leader has called for him to vote against some measures favored by his constituents. One observer, however, discounted the danger: "Charlie Halleck's always been in trouble in his district."

Rep John Saylor (R-Pa.)—The ranking Republican on the powerful House Interior Committee, a middle-of-the-road Republican, seems certain of re-election against Democrat William Patton.

Rep Ben Jensen (R-Iowa)—A vocal champion of conservatism, seems a sure winner in November. Jensen, like Rep Hiestand, has criticized proposed expansion of the REA program.

Rep Ancher Nelson (R-Minn.)—The former REA Administrator, also seems certain of re-election this fall. Nelson opposes the policies of NRECA Gen Mgr Clyde Ellis, and charged in his 1958 campaign that Ellis tried to have him defeated.

Sure Democratic winners in the "solid south" are Reps Hale Boggs (La.), sponsor of a bill to permit tax deductions for contributions to certain political groups and activities; Wilbur Mills (Ark.) House Ways & Means Committee chairman; Oren Harris (Ark.) House Commerce Committee chairman; James Trimble (Ark.), author of the controversial "Trimble Bill" to revise cost allocations for federal multi-purpose projects by reducing the amount of construction cost reimbursable by power revenues.

Power Switchgear Assemblies Case Postponed

The federal government's anti-trust trial on power switchgear assemblies in Philadelphia has been postponed until Oct 31. Although the counsels for General Electric Co and Westinghouse Electric Corp had earlier requested a delay until next year, Chief Judge J. Cullen Ganey said this was not the reason for the postponement. According to the judge, the new date was set because of a docket conflict involving an unrelated trial.

Throughout the one and three-quarter hour proceedings last week, Judge Ganey stressed a desire to speed up the trials. "We have got to get away from this long delay in anti-trust suits," he said at one point.

In another move, the judge delayed a decision on GE Vp, A. F. Vinson's motion for a separate trial.

Part of the GE and Westinghouse arguments for a delay rested on the fact that they would not have sufficient time "to review and investigate the voluminous documentary material . . . and to interview numerous witnesses," involved in the trial. The other part of the argument, stressed mainly by Westinghouse counsel, but seconded by the GE counsel, was that other indictments involved equipment used in power switchgear assemblies, and since some of the meetings and participants involved in those indictments were the same, there was a probability of double jeopardy.

As a result, more time was needed to scan documents in the other cases as well as in the first one, up for trial. Westinghouse counsel Bruce Bromley also pointed out that the government had not returned bills of particulars requested for the other cases, and that these would have an important bearing in determining the double jeopardy issue.

The government countered with a denial of the double jeopardy issue and added that it did not feel it should be held, "in the straightjacket of a bill of particular issued now for a trial that might not come up for two years."

Bromley also said he had "gone to Washington to see 'Brother' Bicks (acting head of the anti-trust division) and had charged the Justice Department with "flagrantly disregarding constitutional protection against double jeopardy by fragmenting one offense and separating it into various parts according to their whims." Bromley said the judge would have to decide eventually which case to try and dismiss the other indictments.

Judge Ganey replied that he couldn't tell now whether double jeopardy was involved and that the best way to find out was to proceed with the trials. He said that if investigations by GE and Westinghouse between now and the trial date showed double jeopardy, "I'll be glad to hear about it at any time."

Also discussed were GE and Westinghouse motions to look at the other companies impounded records. Counsel for all but one of the other companies involved told Judge Ganey they were agreeable.

Political Parties Agree On California Water Plan

Republican and Democratic state conventions in California produced general agreement on water development plans.

Republicans, however, remained silent on a proposal to issue bonds to finance the program. The bond issue is on the November ballot. The fact they did not oppose it is considered as a strong point to indicate that the bond issue will pass.

Co-op Squabbles Hit Three States

- **Mississippi: Court decree blocks 58-Mw G&T plans**
- **Oklahoma: Co-ops dispute Grand River Dam agreements**
- **Illinois: State body calls co-op rate plea unjustified**

Rates, franchises, and co-op plans for new generation were breeding disputes between investor-owned utilities and co-ops in three states this month. At the root of the troubles were conflicts between co-ops efforts to obtain large chunks of non-private generation and the utilities efforts to protect themselves against incursions on non-rural customers.

In Mississippi, four co-operatives, armed with a $16-million REA loan and a desire to be self-sufficient, found their plans for a 58-Mw generating plant blocked at least temporarily this month. The setback came when a county chancery court acting on an application by Mississippi Power & Light Co and Mississippi Power Co issued an interlocutory decree blocking immediate action by the Public Service Commission on the co-op's application for a plant construction permit. The decree will permit the two utility companies to appeal from the PSC's refusal to dismiss the co-op's permit.

The four co-ops—the Dixie Electric Power Assn, the Southern Pine Electric Power Assn, the Pearl Valley Electric Power Assn, and the Singing River Electric Power Assn,—have a peak load of about 40 Mw. Jointly they have formed the South Mississippi Electric Power Assn, a generating and transmitting group, which intends to build a plant with two 20-Mw gas-fired steam generators and an 18-Mw gas turbine.

The two private utilities are fighting the co-op's application on the grounds that it is a duplication of service they already provide. Moreover, they contend that their power would be less expensive than that generated by the co-ops—about 7 mills in the utilities latest offer, against about 9 mills for co-op generation. One other co-op has already accepted a Mississippi Power offer providing a ten-year contract, with power at 7 mills for the first five years and adjustable thereafter.

Moreover, Mississippi Power Co says it is entitled to a "grandfather" certificate which includes service to the co-ops. In its application for its Gulf Coast plant No. 3 unit, a 112-Mw unit announced last November, Mississippi Power stated that it was for all service including the co-ops.

In Illinois, a battle between two investor-owned utilities and three co-ops over a short-term power supply contract got hotter as both parties objected to an 11.25-mill rate set by the Illinois Commerce Commission. At the root of the trouble is the co-ops' effort to obtain four-year contracts from Illinois Power Co and Central Illinois Public Service Co at the same 8.4 to 8.9-mill rates as 16 other co-ops who recently signed ten-year contracts with the two private companies. Illinois Power and Central Illinois PS asked for 13.5-mill rate. Both parties filed for a rehearing.

Co-ops Plan G&T Body

The three contending co-ops—Egyptian Electric Co-op, Southern Illinois Electric Co-op, and Southeastern Illinois Electric Co-op—have been granted a $26 million REA loan and formed a generating and transmission co-operative to build a power plant. It is expected to be ready in about three years.

The Commerce Commission turned down the co-ops' request for the long-term rate, commenting that the request, "overlooks the fact that the rate to the 16 cooperatives is a competitively reduced rate designed to forestall competition. Its extension to the three Southern cooperatives can not be justified as they are apparently making arrangements to obtain their requirements from other sources."

For Illinois Power, who serves one of the three co-ops, the difference between the 13.5-mill rate requested and the 11.25 mill rate granted amounts to $32,000 per year; for CIPSCo, $250,000.

Prior to the Commerce Commission ruling, the two companies filed a petition asking that the three co-operatives involved be classed as public utilities.

In Oklahoma, opposition of the Grand River Dam Authority's wholesale co-op customers to the rate schedule proposed between Grand River Dam Authority and Public Service of Oklahoma reached a new note of bitterness when Kamo Electric Co-op accused FPC Examiner William J. Costello of issuing an erroneous decision in favor of the proposed rates. Subsequently, the full commission threw out the Kamo accusation—which appeared in the co-op's legal brief of "exceptions to the initial decision."

The FPC has set Sept 13 for oral arguments on the rate case and the GRDA's application for an increase in generating capacity.

Kamo attorney Lambert McAllister, a former FPC assistant general counsel, said of Examiner Costello' decision: "It is doubted if ever a more confused and preposterous decision has come before this commission for review. . . ."

The FPC, in turn, called McAllister's brief unacceptable because it concerned "the personal character, motives and integrity of the presiding examiner, rather than being confined to . . . fact and law. . . ."

Examiner Costello admitted it wasn't "a typical or conventional rate schedule" because it contained "certain alleged benefits, which flow from company to authority and from authority to company, which are not expressed in dollars and which both of the parties firmly contend are of immense value. He added it involved events which hadn't taken place at the time the contract was proposed—referring to GRDA's proposed construction of a 100-Mw hydro power plant at Markham Ferry dam site, Okla.

Thus he ruled that a regular cost-of-service schedule couldn't be set.

Kamo—which claims its customers would be damaged financially by the proposed contract—said Costello was required by law to judge the proposed contract on a cost-of-service basis, and criticized his "new and novel philosophy or rate regulation."

Irrigation Districts Fight 500-Kv

- **Threat of competing power worries irrigation men**
- **PG&E spokesman warns imports of firm power may hinder marketing of state's Feather River power**
- **Consultant claims tie and 300-Mw Cle Elum plant will make one million kw available for 5-day, 70-hr week**

PROPOSED 500-KV tie links Bonneville area with southern California

The proposed California-Bonneville Power Authority 500-kv intertie got a rough going over at a California Senate meeting last month as representatives of local irrigation districts and the Pacific Gas & Electric Co warned that large imports of Northwest power could delay development of local water projects and raise serious marketing problems. The warning came as California authorized H. Zinder & Associates to look at coordination of the 500-kv ties with Canadian and Colorado River basin projects in the second and definitive stage of their transmission study. The second stage of the study is expected to be completed this year.

Although the Irrigation Districts of California, represented by Robert T. Durbrow, said they would be interested in documentation of any new source of low-cost power that would not interfere with California water development, they pointed out that 14 water projects—planned, building or completed and involving their members—depend on sale of hydro power for their economic feasibility. As the run-off season in the Northwest is often quite similar to that in California, the local projects are vulnerable to competitive Northwest power, they claimed.

Any import that would interfere with the orderly and timely development of state water resources would be a disservice to California, they continued. Probing for further details on the proposed 500-kv tie, Durbrow posed these questions:

- How much Northwest power can be absorbed in California in the summer, when irrigation releases and incidental hydro power are the highest?
- If Northwest power is used for irrigation pumping, what power sources would be used in those months when no Northwest power is available?
- Wouldn't it be judicious to look at in-state development before importing large quantities of power?
- If the California sales will justify a steam plant in Washington and the 500-kv tie, wouldn't a steam plant a few miles from the California load center be a better investment?

Supporting Durbrow's contentions, Robert H. Gerdes, executive vice-president of PG&E, urged that power from local water and power development projects be given priority in the California market. Additions of 4-million kw of hydroelectric resources have been estimated in northern and central California before 1985, with 2.2-million kw of this before 1970. Absorption of this large quantity of peaking power will require careful scheduling to give maximum value to power produced.

Fuel Contracts Affect Hydro Use

PG&E, it has been estimated, could take up to 2-billion kwhr per year of dump energy from BPA consistent with other obligations. This conclusion gave consideration to the fact that the utility is compelled to make contracts for minimum purchases of gas and oil to assure availability. It is the utility's belief that importation of firm power, or more than 2-billion kwhr per year of dump energy, would seriously jeopardize water conservation in California by federal and state and local public and private agencies and could hurt California oil and gas industries, said Gerdes.

The PG&E spokesman said the BPA plan to send surplus power up to 2-billion kwhr per year over a 97-mile, 230-kv line from Klamath Falls to the PG&E Pit No. 3 Powerhouse is the only financially feasible plan according to an exhaustive study of many proposed interconnections between the Northwest and California completed by BPA and other agencies last February. (EW, Feb 8, p 32). The average estimated cost of such energy, after transmission losses, would be 3 mills per kwhr at load center. PG&E has offered to sell and deliver off-peak energy for pumping at the state's proposed Feather River Project in an amount equivalent to that purchased in any year from BPA under the proposed contract. The charge would not exceed what PG&E pays BPA, plus the cost of incremental transmission and connection facilities for the pumps.

Gerdes said imports of Northwest firm power would also interfere

California-Bonneville Intertie

with marketing of power from the State's Feather River Project, particularly in view of the necessity of providing a market for power produced by the proposed pump storage in the State water plan.

In the 90-Mw Oroville-Wyandotte Project now under construction on the Feather River, sale of about 400 million kwhr to PG&E over a 50-year period will support repayment of $65-million in revenue bonds. Capacity factor of this peaking power is expected to be 41.5%, about the same as the 500-kv tie.

It is difficult to see, Gerdes said, how importation of firm power would serve the pumping requirements of the California water plan. In a dry year this low capacity factor power would not be sufficient to meet the pumping loads.

Commenting on the proposed tie, Harry A. Lott of Southern California Edison Co, said his company was not aware of any study showing a firm, year-round power supply available for export from the Northwest. Based on its experience with transmission line costs, his company believes that Northwest power could not compete with local sources unless the receiver pays part of the transmission and production costs, he said. Years of experience, he continued, indicate that the company must control the operation of its generation and transmission facilities to assure quality service.

Los Angeles Supports Tie

Support for the 500-kv tie came from Ivan L. Bateman, chief electrical engineer and assistant city manager of Los Angeles. He said the city would favor power from the Northwest if cost and reliability were comparable to thermal power.

Such power would delay the construction of thermal plants and conserve fuel as well as reduce the smog problem in the Los Angeles basin, he claimed.

Sol E. Schultz, H. Zinder & Associates, said that the study had considered the effect of the proposed 500-kv interconnection on feasibility of contemplated California hydro projects. The market for power from these sites, which are essentially all in northern and central California, is now confined to these areas. The interconnection, which would traverse almost the entire state, would open up southern markets for these developments and increase their feasibility.

PG&E advised us, said Schultz, that it would not be interested in purchasing power from an interconnection it does not build and operate. Accordingly, the area served by that company was discounted as a possible market. The interconnection thus poses no threat to potential markets of proposed hydro developments in California. It would, however, defer construction of fossil fuel and atomic energy plants, thus conserving exhaustible fuel resources.

Reiterating and amplifying his statements before a June meeting of the US Senate Interior Committee (EW, June 20, p 83), Schultz said:

- Coordinated interregional operation can be attained with a two-circuit 500-kv transmission connection from the Bonneville grid to southern California. Serving as a common carrier, the line would have a firm capacity of 1.6-million kw and a maximum capacity of more than 2-million kw.
- Using surplus Northwest peaking capacity, 1-million kw of firm power can be sold to California utilities to be used continuously over the peak hours, 8 am to 10 pm, Monday through Friday, except holidays. This would be provided by a 300 Mw coal-fired steam plant at Cle Elum, Wash., and 700 Mw of hydro-peaking capacity, of which a surplus is expected for at least ten years and probably longer. The steam plant would supply power to California when dry years did not provide hydro for substantial periods.
- At the assumed 1968-69 estimated level of Pacific Northwest loads and resources, 9.7-billion kwhr of secondary energy would be available under average hydro conditions. The amount would vary from 4.4-billion kwhr in a critical year to 25.8-billion in a good year.
- Coordinated operation of Pacific Northwest and California systems would reduce the need for spinning reserves. A peak load diversity of 500 Mw will exist among Pacific Coast utility systems by 1964-65 and will increase in later years. During the period from 1964 to 1974, in which the line costs are expected to be fully amortized, it is estimated that the average incremental cost of gas and/or oil for generation in California will be 4.0 mills per kwhr, assuming $2.40 per bbl of oil. Estimated annual fixed costs of generating capacity will be at least $15 per kw.

See $58 Million Yearly Revenue

Answering a Senator's question, Schultz said his study is based on selling Northwest power in California at these prices but obtaining it at zero cost from Bonneville, since the power is otherwise unused.

- Anticipated annual gross return from operation of the twin-circuit interconnection in as average year in the Pacific Northwest is $58-million. About $29-million would cover annual costs of transmission and generating facilities, leaving a net benefit of $29-million—sufficient to shorten the period for amortizing transmission investment to ten years and provide $12-million to be divided between the two regions.

Schultz indicated the $200-million cost of transmission facilities plus interest could conceivably be paid off at $50-million per year in five years. These figures include annual charges for the steam plant but not its original cost, he said.

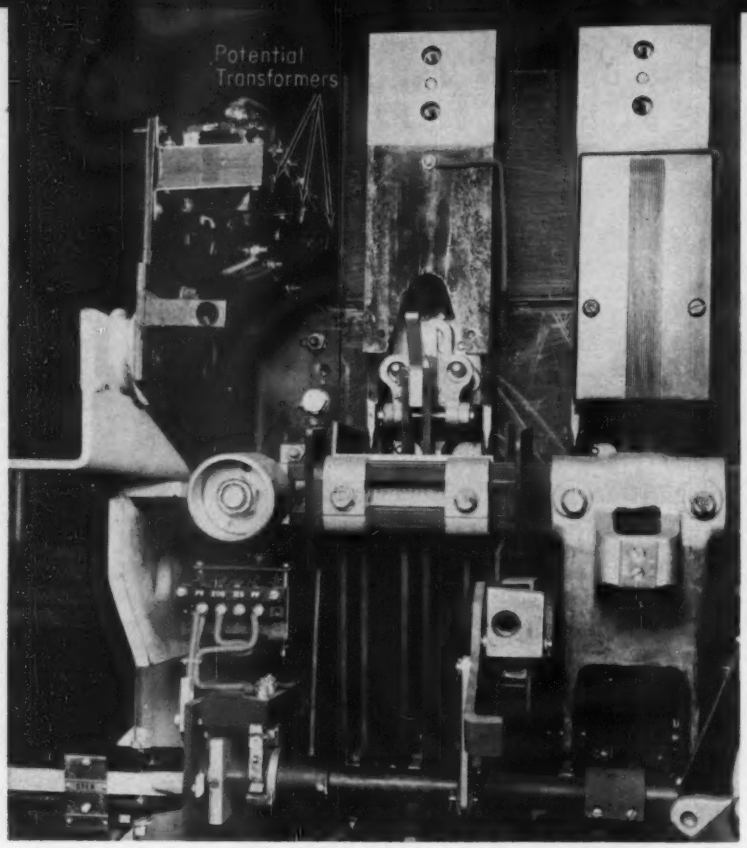
These preliminary findings may be altered somewhat in the Stage 1 report to be issued in September, but Schultz anticipates no significant changes. It will demonstrate beyond any reasonable doubt, he said, that the proposed high-capacity interconnection will provide major and lasting benefits to the two areas and the nation.

Members of the Fact Finding Committee questioned Schultz regarding the expected cost in California of power generated in the Northwest and other benefits of the interconnection to California. These questions pointed up the skepticism evident at the hearing.

Schultz told EW the Stage I and II reports when issued would answer many of these questions.

Network

Higher-voltage systems' evolution requires careful selection of relays, based on purpose and their intrinsic differences



CIRCUIT BREAKER UNIT has six (three shown) potential transformers which are connected to each phase on both the transformer and the network sides of protector

J. L. UBER, Assembled Switchgear and Devices Dept, Westinghouse Electric Corp, East Pittsburgh, Pa.

The evolution of higher voltage network systems has made available two variations of higher voltage (460-v nominal) network protectors. A user entering the higher voltage network field for the first time must decide which variation best suits his purpose.

The basic difference between the variations lies within the relays. One variation employs 460-v relays; the other is equipped with 216-v relays.

At the time when the 460-v protector was planned in the early Thirties it was believed that the most reasonable and direct approach was to design a protector closely approximating the 216-v design. The best approach was to design a 480-v relay with the same characteristics as the 216-v relay, and this was done.

All the early applications of higher voltage network protectors used the higher voltage relays. It was not until 1954 that an alternative approach came into being. This second approach differs from the 460-v relay in that potential autotransformers are connected to each phase on both the transformer and network sides of the protector circuit breaker unit. This permits the 216-v relays to be connected to appropriate taps on the autotransformers.

Fig 1 is a single line wiring diagram showing the locations of various relay coils in the circuit of 460-v relays. Fig 2 shows the addition of autotransformers required to make use of 216-v relays.

For this discussion, the current coils of the master relay are not involved, because they are energized from current transformers and have nothing to do with voltage. Neither is the desensitizing relay involved, for its instantaneous elements are energized from current transformers, and the heater transformer of the time delay element is connected to an appropriate tap of a separate control autotransformer.

As with any metering through current or potential transformers, ratio correction factor and phase angle error must be considered. Connecting coils of standard 216-v relays across the 125-v taps of the potential autotransformers will introduce a change in the relay's operating characteristics. In fact, if no compensating means are provided, the relays would require recalibrations when applied to 480-v service.

In both master and phasing relays, the potential-coil flux will alone produce sufficient torque to move the contacts to a neutral position. With nominal voltage, neither "trip" nor "close" contacts will be made. Current-coil flux interacts with potential-coil flux to make the "trip" contacts of the master relay. Phasing-coil flux interacts with potential flux and causes the master and phasing relay contacts to make in the "close" position. Since the contact neutral position is determined solely by network voltage, the deviation from the calibrated voltage affects both the tripping and closing.

Voltage deviation affects overvoltage closing and reverse current tripping functions of the master relay but has negligible effect on overvoltage closing function of the phasing relay. It has been easy to compensate for ratio error by bringing out taps from the primary of the autotransformers. Unfortunately,

Protection Satisfies 480-v Needs

this turns compensation will not correct phase angle deviation.

Phase angle error will have a negligible effect on master relay closing. On master relay tripping the trip curve will be rotated counterclockwise, but this is also negligible. The closing function of the phasing relay, however, is affected by phase angle error. Compensation must be provided before a 216-v relay, without recalibration, can be assembled on a 480-v protector.

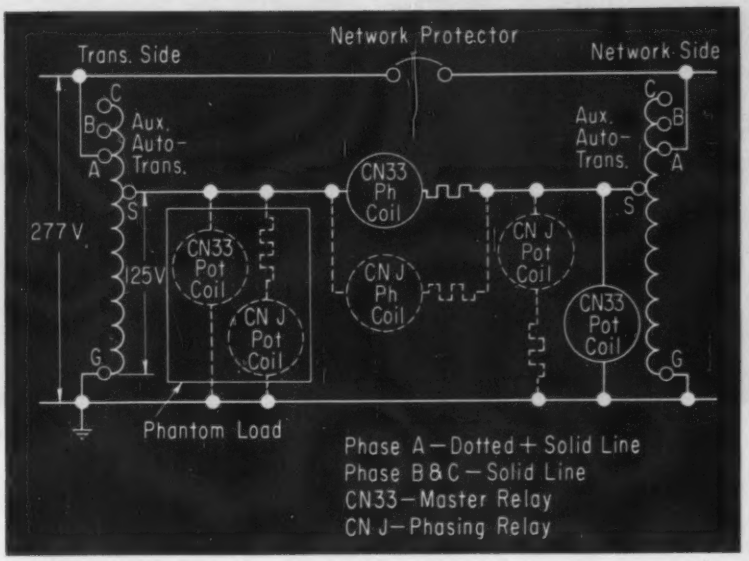
Phasing coils are connected between the 125-v taps of the autotransformers and are energized by the difference in voltage between the two auxiliary potential transformers. The phasing coils present a negligible burden to the potential transformers, at least in the critical operating range of 0.5 to 2.5 v or currents on the order of 0.25 to 2.0 milliamp. Note, Fig 1, the additional burden of the master-relay potential coils on the network-side autotransformers of phases B and C.

Phase A network autotransformer has both master and phasing potential coils connected as additional burden, and this causes the maximum phase deviation of about 2 deg.

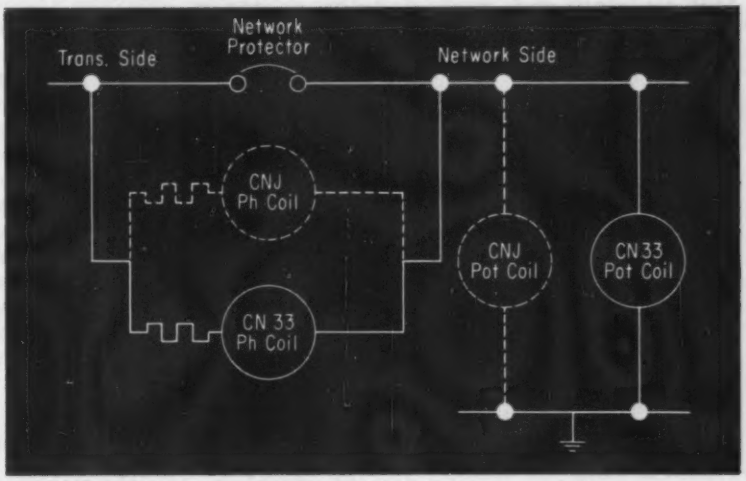
In effect, this has the phasing coils looking at a 2-deg phase difference between the transformer and network sides.

Voltage deviation has been corrected. Now remains the task of correcting phase angle error. Since the phasing relay is connected across phase A, compensation need be provided for this phase only. Several schemes are readily apparent to accomplish this correction.

The simplest method, requiring the least additional space, is to connect a burden, equal to the relay potential-coil burden, to the corresponding potential autotransformer on phase A of the transformer side of the protector. This potential autotransformer will then also give a 2-deg phase shift which nullifies the influence of the shift at the network side. With this addition the phasing coil will not see any phase-angle difference between the transformer and network sides.



1—**DIAGRAM** shows connections of CN33 and CNJ potential and phasing coils for the 480-v systems which are employing 480-v relays in their protection

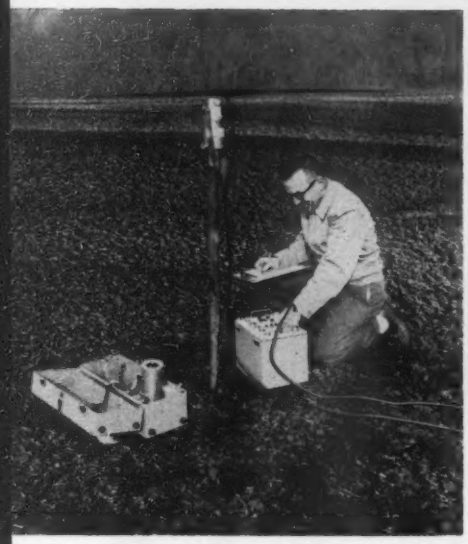


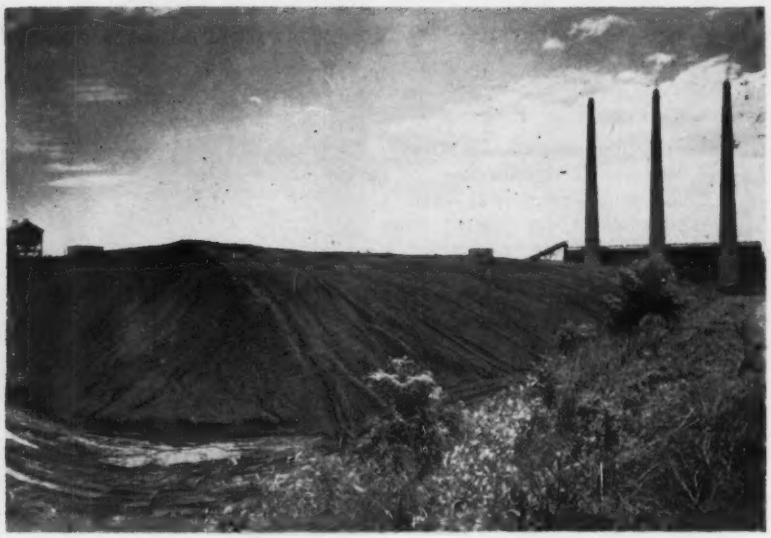
2—**SCHEMATIC** shows the connections of CN33 and CNJ potential and phasing coils for 480-v systems employing autotransformers with 216-v relays

The additional burden is known as the "dummy burden" or "phantom load." It is nothing more than two relay potential coils with appropriate resistance connected to the line, serving no other purpose than correcting phase angle. Phase-angle error can also be reduced without "phantom loads" if larger, special autotransformers are used.

Correcting phase angle removes the last objectionable feature remaining and now permits the interchange of the 216-v relays between the 216 and 480-v protectors with little difference detected in their operation.

Quite naturally each system has its advantages, the 460-v relays having these:





Coal density probe in use on . . . Coal pile at Clifty Creek Station of Ohio Valley Electric Corp

Radioactive Probes Measure

AEP standardized method helps reconcile steam plant book and physical inventory

B. B. BONADIO, Chief Chemist, Indiana-Kentucky Electric Corp, Madison, Ind.

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Radioactive measurement of the in-place density and moisture content of large coal storage piles has been standardized by American Electric Power Corp, following 18 months of testing of the approved method. Such measurements are steps in taking an inventory of a steam-electric plant's coal on hand.

Physical inventory of coal piles assumes more importance as generating stations and their annual coal consumption grow bigger. As plant annual coal consumption ranges up to 4-million tons, a small percentage error in weighing at a plant represents a substantial quantity of coal. This quantity is reflected as a difference between the book and physical inventories. A better measurement of density and moisture in the pile improves the physical inventory.

Such an inventory involves measuring total volume, average in-place density, and average in-place moisture content.

Although procedures for determining total volume have been satisfactory, instruments for gauging in-place density and moisture were limited to measurement near the pile's surface. Accordingly, AEP, Ohio Valley Electric Corp, and the Indiana-Kentucky Electric Corp undertook a study and development program. Nuclear-Chicago Corp had an instrument for density and moisture measurement, which appeared to offer improved techniques, and, upon invitation, participated.

OVEC's relationship with the U. S. Atomic Energy Commission in providing power for the latter's Portsmouth area involved AEC in the early stages, and the AEC is sponsoring further studies seeking the method's refinement.

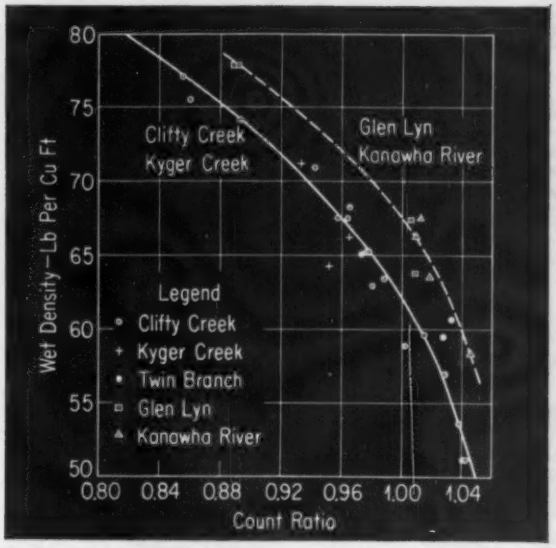
Nuclear-Chicago's density probe, a tube about 1½ by 18-in., contains a source of gamma radiation, a radiation detector, and a preamplifier. The detector, shielded from the source, "sees" only scattered radiation, the amount of which is essentially a function of the density of the material surrounding the probe. An electronic scaler counts pulses per min from the detector.

Calibrated for Hydrogen Content

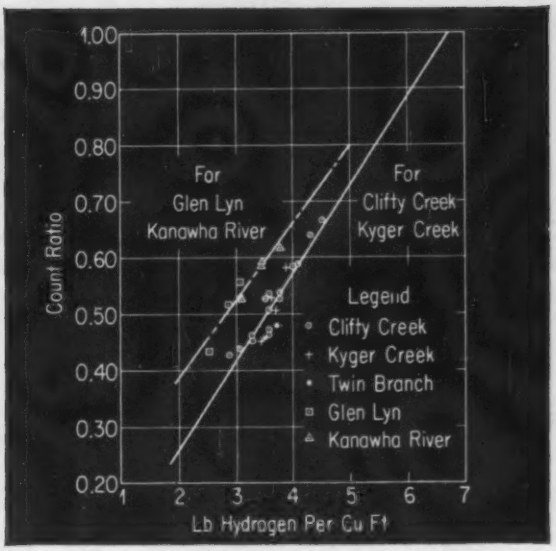
The moisture probe is similar, except that it contains a source of fast neutrons. Its detector is sensitive only to slow neutrons. As hydrogen is the principal neutron moderator in coal, the instrument is calibrated in terms of total hydrogen content of the coal surrounding the probe.

To use either instrument, an access tube of seamless steel tubing, $1\frac{1}{16}$ in. OD by 16-gage wall and having a driving point, is driven into the coal to the required depth. Care is taken to prevent bowing which could hamper the traveling probe. Although a jack hammer is often sufficient for driving, a simple pile driver with a 300-lb weight is sometimes necessary.

Tests, preceding actual calibration, determined the size of the sphere of influence of the probe in coal to



1—**DENSITY PROBE CALIBRATION CURVE** shows that three of five coals tested appear to fit on a single curve



2—**MOISTURE PROBE CALIBRATION CURVE** shows two curves with five coals aligned as in Fig 1

Coal-Pile Density and Moisture

allow selection of a container size for the calibration standards. Standard 55-gal oil drums used originally were found to be too small for low-density coal, so that special tubs, 30 in. dia and 30 in. deep, replaced them.

To compensate for the decay in source strength and changes due to replacement of detector components, a reading in water was used as a base value. Calibrations on the ratio of a reading in a given coal to the reading in water proved satisfactory. Calibration was carried out by compacting coal in the containers carefully to obtain different values of density.

Average Densities Calculated

Moisture contents were varied by adding moisture in steps to air-dried coal, coal and water being mixed in a concrete mixer. The volume of each container was determined carefully. After compaction, the containers were weighed on a calibrated platform scale, and average densities were calculated. An access tube was then driven into the container, and the probe was located where its effective center was at the center of the container.

In the water standard and in the coal, counts were taken for 20 1-min intervals as measured on a stopwatch. In some cases, counts were also taken for 2, 5, and 10 min. As disintegration of the radioactive source is not at a uniform rate, some improvements resulted from longer readings. In practice, however, two 1-min counting intervals are sufficient when the timing is consistent.

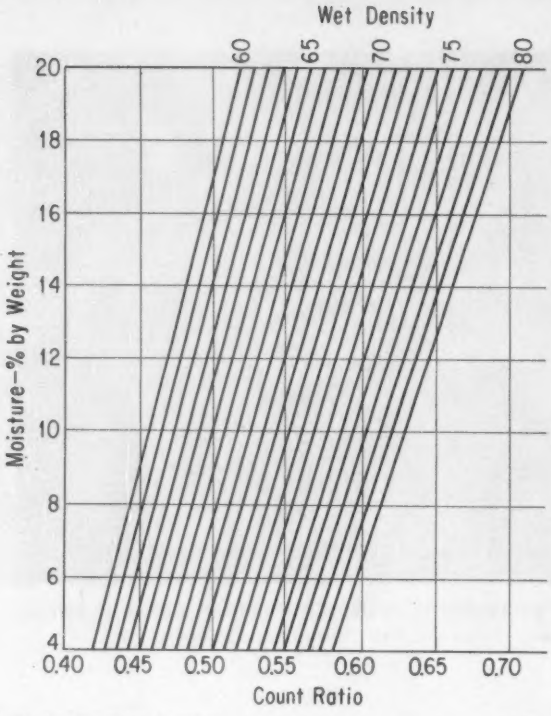
Five different coals were used in the calibration runs. These coals gave a range of hydrogen content representative of most eastern U. S. bituminous coals.

The moisture probe's readings are related to total hydrogen, the instrument being unable to distinguish between hydrogen present in water and that chemically bound in the coal. Thus coal samples were taken from each calibration standard for the moisture probe, and total moisture and dry hydrogen contents were determined for each sample. These data were converted to pounds of hydrogen per cu ft of coal, density of each sample being taken into account. With these values and the count ratio obtained in each standard, basic calibration curves were developed.

Once a base curve is established by test, a working curve can be calculated which relates count ratio, density, and moisture content of a given coal. The ratio of chemically-bound hydrogen to water hydrogen generally is such that the amount of chemically-bound hydrogen must be known quite accurately for the working calibration curve to be reliable.

The scattering effect on the gamma radiation of the density probe is a function of electron, not mass density. Although all elements present in coal, except hydrogen, have a ratio of atomic weight to atomic number of about 2 to 1, hydrogen is about 1 to 1. Compared with other elements, hydrogen has twice the effect on the probe reading in proportion to its density. This effect was ignored in plotting calibration curves. The effect on the individual readings is rather small, less than the scatter in the data.

To set up a logical basis for sampling a large storage pile, a small portion of it was sampled extensively. This involved driving 25 access tubes on 5-ft centers in a square grid arrangement. Density and moisture readings were taken at each 2 ft of elevation over



3 **WORKING CURVE,** derived from base curves, relates count ratio, density, moisture for given coal

Table I—Analyses of coals are on a dry basis

Plant	Description
Clifty Creek	Mixture of southern Indiana and western Kentucky coals from storage pile.
Glen Lyn	Pocahontas No. 3, Wyoming Co., W. Va.
Kanawha River	Winifrede Seam, Kanawha Co., W. Va.
Kyger Creek	Pittsburgh No. 8, Belmont Co., Ohio
Twin Branch	No. 3 Brazil, Clinton District, Clay Co., Ind.

Table II—Density Probe Readings

Depth	Tube Number							
	1	2	3	21	22	23	41	43
2	75.25	75.40	74.70	76.00	72.05	72.60	67.60	77.20
4	71.80	75.95	73.43	76.70	69.95	67.60	73.00	71.15
6	73.25	73.95	74.00	76.00	72.15	65.20	72.30	73.10
8	72.30	71.65	72.55	72.90	70.80	70.60	77.95	73.55
10	71.20	69.70	72.10	73.90	66.60	76.90	79.00	72.50
12	74.75	71.85	73.90	78.60	70.30	73.10	76.90	73.90
14	72.50	72.40	69.80	78.50	71.25	74.75	76.50	76.10
16	73.80	76.20	74.15	81.30	76.10	74.85	75.25	77.95
18	77.00	77.05	76.00	78.00	76.00	74.20	76.25	79.90
20	78.50	74.95	73.80	77.95	76.30	70.95	78.50	72.40
22	77.70	74.00	73.95	76.90	74.40	77.55	75.50	76.20
24	75.50	77.95	71.40	77.00	75.95	71.58	73.15	75.70
26	72.85	77.00	74.75	76.15	73.80	66.10	72.05	76.25
28	76.85	73.55	75.75	75.50	71.60	73.55	.....	77.26
30	78.50	73.60	72.85	75.90	72.60	75.78	.....	.....
Ave.	74.78	74.35	73.54	76.75	72.66	72.35	74.92	75.23

the total depth of 18 ft. The data obtained were used to estimate the variance of density and moisture.

Such a sampling procedure must be based on the number of access tubes to be driven and of readings to be taken in each tube. As driving access tubes is the most expensive part of this operation, the procedure calls for the fewest consistent with the desired accuracy.

On the basis of data taken in the small section of a storage pile, it was decided to drive 50 access tubes spaced over the storage pile and to take readings at 2-ft intervals in each tube. This pattern was applied to a storage pile about 400 by 1,500 ft. Each access tube was driven about two-thirds of the depth of the pile, thus allowing tube lengths of 20 to 36 ft. This sampling was expected to result in oversampling.

The ratio of access tubes to levels sampled was calculated and the number of access tubes giving an expected standard deviation of ± 0.30 was calculated. The number of levels should be 1.25 times the number of access tubes, and the latter should be 13. The access tube lengths for the two storage piles average 27 ft. For 18 in. between levels as a practical minimum, an average of 16 levels per tube can be obtained. With the optimum 13 tubes, the expected standard deviation would be ± 0.37 lb per cu ft.

When the procedure was carried out on a second storage pile, the estimates of variance were slightly lower than those for the first pile. But the same sampling procedure, based on the larger variances, has been used in all subsequent inventories of both piles.

In the subsequent inventories, the number of access tubes driven was arbitrarily increased from 13 to 25. Although this ratio of access tubes to levels appears to be inefficient, the variance due to level was reduced by going to 18 in. between levels. The sphere of influence of the radiation device is such that there is an overlap at that spacing. This has had the effect of smoothing out the data.

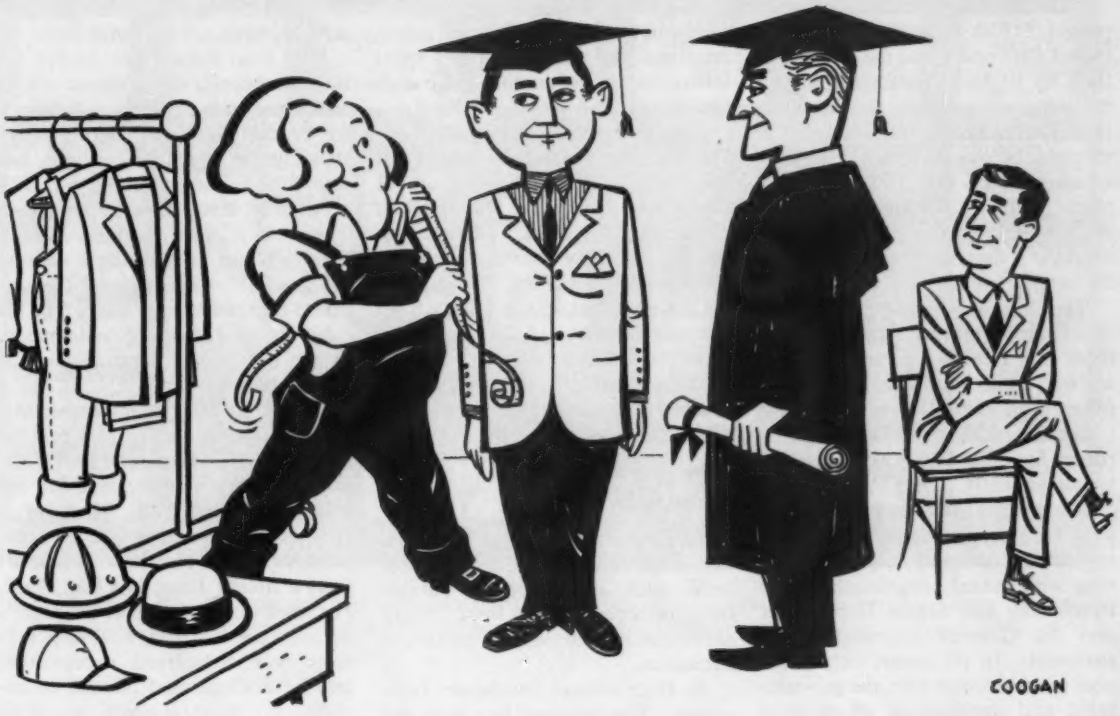
Two successive samplings of a portion of one storage pile, which was undisturbed between samplings, gave average densities differing by only 0.15 lb per cu ft.

These sampling studies reveal an appreciable variation of density in a storage pile. Any inventory must include sampling in depth to be accurate.

Moisture-content measurement is feasible when the chemically bound hydrogen content of a coal pile can be established with enough accuracy. In trying to determine the moisture content of two storage piles, core samples were taken in each concurrently with probe measurements. These cores were taken by means of a hollow casing driven into a pile. The casing was driven 2 to 6 ft before friction built up to the limit of the driving equipment. The casing was then pulled, emptied, and redriven, this procedure continuing until the required depth was reached.

The moisture probe and core samples gave statistically equivalent values for the moisture content of one storage pile. The second pile, however, gave drastically different results, the difference being greater than could be explained by any reasonable error in the value used for the chemically bound hydrogen content. Accordingly, core sampling has been used in subsequent inventories.

From the original data, the variance of moisture in each pile was estimated. This estimate was used to determine the number of core samples for giving a standard deviation of ± 0.5% moisture. It took ten.



Today a Cadet, Tomorrow a Boss

Con Edison selects cadets, their biographies show, to form an elite, shaping their own along with company's future

Today's cadets will be tomorrow's managers!

Such is the promise Consolidated Edison holds out to college graduates. The promise underlies the company's cadet training program.

"It allowed me to see what the company had to offer in the field where I felt that I had the best prospect of building a future, and I got this while working on the job," said one graduate of the two-year program.

"After college and the Marine Corps, I pitched on sales work as that in which I was most likely to succeed, and Con Edison gave me the chance to prove that I was right."

After two years as a cadet, this Niagara University liberal arts graduate advanced in another two years to assistant bureau head in Sales Promotion.

"I like talking to dealers and contractors and I especially like the fact that I'm selling ideas not products," he concluded after noting a variety of jobs the program has tried him in, beginning with the Public Information Department.

Recruitment practices vary in different companies, but the measure of Con Edison's is the commendations of those who went through the cadet experience. Such recruits, of course, are carefully selected on the basis of their college attainments, their personal qualifications, their interest in the program. Thereafter, they are acclimated, coached, and advanced in such a way as to bring out their best abilities.

Men, Ideas Essential

Applicants become cadets because, in management's judgment, they can be expected to develop and apply the engineering and business techniques essential to a progressive utility company. They then become part of a company in whose service area the demand for electric power is expected to increase by more than half in the next ten years. This demand cannot be met by merely installing and using more equipment.

While the company pioneers in the development of new equipment and new engineering applications, it must have on hand the men who can keep pace with its growth, working creatively in their own fields to develop and apply engineering and business techniques. Con Edison does practically all its own engineering work, constantly searching for new and more efficient ways of doing things. Illustrative of this is its present pioneering use of atomic power.

But in every phase of its complex business, Con Edison needs specialists with new ideas and fresh talents who can absorb the knowledge, training, and experience necessary for management. It needs men also for the installation of today's advanced types of electronic equipment for handling accounting, billing, payrolls, and the many engineering calculations.

Today's manager of the Accounts Payable Bureau came to the com-

pany in 1950 after attending Long Island University and the College of the City of New York. He started his company career in the Accounting Department. While still in training, he was assigned to a group which adapted the IBM 705 Electronic Data Processing Machine to processing payrolls. This was the machine's first such application in the utility industry.

The present assistant manager in the Purchasing and Stores Department is a Lehigh University graduate who came into the cadet training program in 1949. He is responsible today for 250 men in 13 storerooms handling $30,000,000 in materials annually.

As a cadet, this man found the program an open door to a satisfying utility company career, beginning with varied assignments in the Purchasing and Stores Department and the General Accounting Department. In the latter, he worked also in connection with the procurement and warehousing of material and equipment and in the associated accounting procedures.

Open to Others Too

His progress in the company stresses the effectiveness of the program as a means of recruiting superior personnel. Notable during his company career was his development of an original inventory transfer control system which employs the company's digital computer.

Although largely for college graduates, bright and ambitious non-college men receive consideration too and, once accepted, have the same opportunities for advancement available to their fellow cadets. Acceptance of any candidate, however, is by no means a guarantee that he will remain either in the cadet program or the company. The program exists as a medium through which successful job applicants can prove themselves. To get a base on a single, you must beat the ball, and you score only by crossing home plate.

Engineering school graduates enter the training program as cadet engineers; all other college graduates, such as those mentioned, come in as cadet analyst. This latter title is rather arbitrary, covering those trained in accountancy, business administration, sales and advertising, mathematics, personnel and public relations, and numerous other specialties important in the company's operations.

The company's day-by-day operations offer special challenges and opportunities to engineering school graduates—electrical, mechanical, chemical, and civil. These are needed to carry the responsibility for planning, designing, and improving the electrical system. They have the responsibility of finding better ways of meeting the constantly growing need for the energy the company furnishes. Here are a few problem areas company engineers are now exploring:

Areas to Be Explored

1. Electrical system stability under conditions of sudden disturbance, such as unexpected outages of generators or tie lines, major short circuits, or loss of generator excitation.

2. High-voltage insulation techniques. The company has programs for improving materials for durability under stress and finding new and better methods of fabrication.

3. Behavior of metals at high temperature or high pressure and in the presence of steam and water and nuclear radiation.

4. Plant operations and load dispatching for creating greater economy of fuel consumption.

5. Development of atomic power, an area in which continuous research must be done and many problems solved before efficient, economical production becomes a reality.

To a selected group of college graduates, Con Edison offers two major advantages. They will have the chance to enter an industry whose growth has been and will continue to be spectacular and where career continuity combines with unlimited opportunity. They will have the chance to be part of an organization in which top positions are opening up rapidly and will continue to open up at an even faster rate in years to come. Most of these places will be filled by men employed now.

Con Edison has 791 top staff and management positions, and in the next 15 years, 750—all but 41—of these jobs will open up through retirement and other attrition. Accordingly, opportunities for rapid advancement are unusual here.

And Con Edison has an eye for unusual people, those whose talents and experience mark them definitely for promotion. One, a graduate of Brooklyn Polytechnic Institute, has established a strong claim for such preferment since his employment in 1949. As a cadet, working on both planning and field projects for the Mechanical Engineering Department, he revealed his caliber in his handling of important assignments in the design and improvement of boiler controls.

As a Con Edison employee, this engineer had a chance to work for two years with General Electric Co on the atomic power plant for the submarine, Sea Wolf. Now, as a senior engineer, he shares importantly in the creation of the company's Indian Point Nuclear Plant. His work on the design of the plant's nuclear portion and auxiliary systems was considered exceptional, and he distinguished himself in coordinating manufacturers' specifications and in integrating the overall plant design. His present responsibilities reflect not only his native abilities, but also the solidity of his earlier company training.

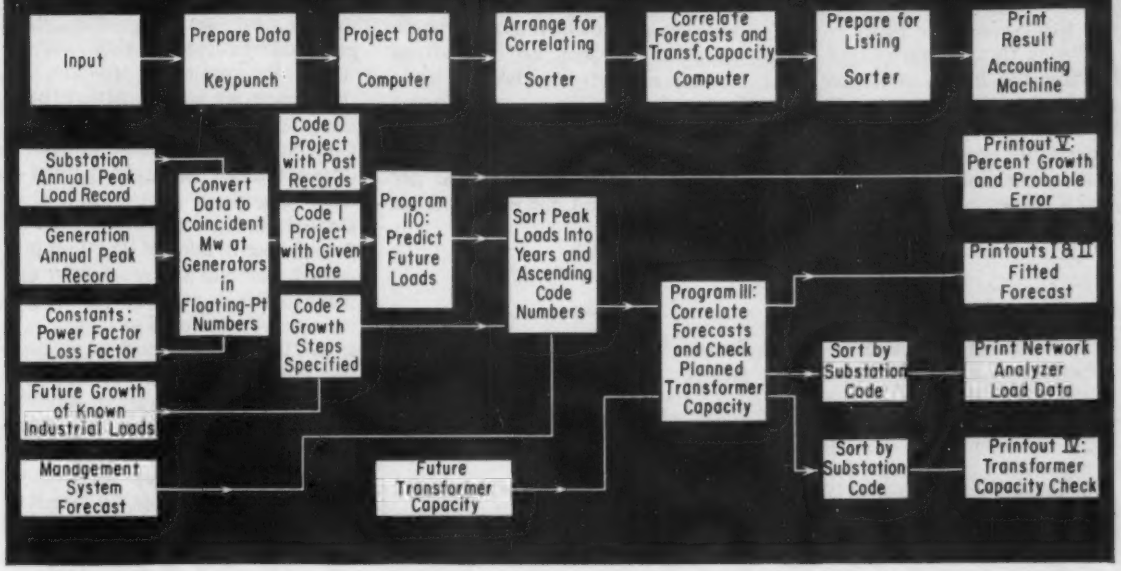
Invention Proves Out

Con Edison was the first utility to announce its readiness to build a generating station fired by nuclear fuels. This announcement came quickly after passage by Congress of the Atomic Energy Act of 1954, which opened up the possibility of such a development by private capital. The company has been doing this, using its own funds, without governmental financial aid.

Such an undertaking has appeal for progressive engineering talent. It appealed to one young engineer who came to the company's cadet training program in 1957. This graduate of the US Merchant Marine Academy at Kings Point, while assigned to the Production Department, invented a combination gas-oil burner incorporating the use of natural gas as a fuel. His invention contributes to system operations.

This young engineer attended the company's nuclear training course while he was assigned to the Mechanical Engineering Department. Today he is one of the 18-man key group at Indian Point.

(*Continued on page* 76)


Input
Prepare Data
Keypunch
Project Data
Computer
Arrange for Correlating
Sorter
Correlate Forecasts and Transf. Capacity
Computer
Prepare for Listing
Sorter
Print Result
Accounting Machine
Substation Annual Peak Load Record
Generation Annual Peak Record
Constants: Power Factor Loss Factor
Future Growth of Known Industrial Loads
Management System Forecast
Convert Data to Coincident Mw at Generators in Floating-Pt Numbers
Code 0 Project with Past Records
Code 1 Project with Given Rate
Code 2 Growth Steps Specified
Program IIO: Predict Future Loads
Sort Peak Loads into Years and Ascending Code Numbers
Future Transformer Capacity
Program III: Correlate Forecasts and Check Planned Transformer Capacity
Sort by Substation Code
Sort by Substation Code
Printout V: Percent Growth and Probable Error
Printouts I & II Fitted Forecast
Print Network Analyzer Load Data
Printout IV: Transformer Capacity Check

FLOW OF DATA through computer and accessory equipment is shown in the upper diagram, with specific operations on data shown in the lower diagram. From raw input, computer prints out ten-year load forecast in 80 min

Computer Speeds Substation Planning

From raw projection data, substation loads are forecast for ten years, including probable excess or deficit capacities

V. W. RUSKIN, Crippen, Ruskin & Associates Engineering Ltd,*

J. H. DRINNAN, Crippen, Ruskin & Associates Engineering Ltd.*

J. B. CLAYTON, B. C. Electric Co, Ltd, Vancouver, B. C.

Forecasting load at different points of a system and planning new substation capacity to meet this load growth can be profitably handled on a digital computer. The main advantages are increased speed of calculation, accuracy, and easily interpreted results.

Review of a utility system such as that of British Columbia Electric Co, which has about 100 existing and planned substations, can be a lengthy process. However, B. C. Engineering Co, as consulting engineers, developed a program for the IBM 650 computer, which offers valuable assistance.

Objectives of the program include:

- A set of mutually consistent load predictions in terms of coincident peak Mw generated.
- A set of mutually consistent load predictions forecasting future non-coincident Mva.
- A tabulation of rate of load growth within the system.
- A schedule of excess or deficit in planned bus and substation transformer capacity.
- A list of predicted substation and bus loads for ac network analyzer studies.

The raw load projection is run once a year on the computer in about 45 min; correlation of data requires an additional 35 min for ten years of forecast. If a change in business requires it, a revised management estimate of the system total may be substituted and the correlation for any given year can be rerun in about 3½ min. Speed of calculation enables estimates to be made quickly of required changes in current and future substation planning.

The program requires that load and generation data initially be brought to a common basis. All data are converted into coincident Mw at the generator terminals by use of appropriate loss and coincidence factors. B. C. Electric system load records are obtained from demand kw and kvar meters or from demand ammeters.

The loss factor increases substation loads to allow for transmission and transformer losses between generating stations and load. While different loss factors may be used for various areas of the system, an overall average factor of 7% is utilized. This percentage was indicated by network analyzer studies.

The coincidence factor scales down each substation load to take into account the diversity between individual peak loads at substations and system peak at the generating stations. The sum of peak loads in terms of generation (including losses) is compared with the annual peak at generating stations to ob-

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Co-authors Ruskin and Drinnan formerly were with B. C. Engineering Co Ltd.

tain this coincidence factor.

During the postwar period B. C. Electric has had a consistent load growth of about 10% annually. System projection on this basis has dependably predicted future system peaks. Because some areas have grown faster than others, however, each area's growth rate must be determined so that sufficient transformer capacity can be provided.

Previously, loads were extrapolated by projecting past records on semi-logarithmic paper; by projecting at an assumed annual percent growth; and, for industrial customers, by using growth steps provided by customer sales forecasts. Thus, the program provides for three methods of automatic projection:

Code 0: Semi-logarithmic projection of past records, using the method of least squares.

Code 1: Projection using a selected growth rate in percent based on past growth rate in the same area and management's expectations of future growth potential.

Code 2: All future load steps specified.

Historical growth of a sub-area is projected by adding the yearly peak coincident Mw of three or more adjacent substations. Because load cut-overs between stations tend to cancel out, the sub-area record reveals a more accurate growth pattern than those of individual stations. Complete flexibility is maintained in the projection by using the same codes as for individual stations.

Experience has shown that the sum of individual load projections of a number of system elements never equals the load obtained when the total system load is projected. There are several reasons: Projections are made by fitting a "line of least squares" to a series of widely-scattered points representing the logarithms of the load; the number of years of record is not the same at all substations, and the rate of growth differs greatly throughout the system. Also some future industrial and substation loads must be arbitrarily estimated. Furthermore, the projections of system elements may be on a purely historical basis, while projection of the total system load may be adjusted to allow for expected business conditions.

Magnitude of the difference may be illustrated by individually projecting the loads of five areas and then adding them. When the peak load record of the sub-system is projected, a forecast will be obtained which differs from the sum of the area loads. Individual bus, substation, sub-area, area, sub-system and system forecasts must then be made consistent with each other. The total system generation forecast based on past records, modified by judgment, is adopted as an overall control.

A mutually consistent set of future system peak load predictions is

Printout I—Fitted Forecast Totals for the System and Eight Areas

Location	Code	Forecast Raw	Forecast Fitted	Factor
System	0 75 0000	1172.32	1172.32	1.0000
Mainland	0 76 1000	1026.97	1013.00	.9864
Island	0 76 2000	161.53	159.33	.9864
Burrard	0 77 1100	711.36	640.79	.9008
Fr Valley	0 77 1200	195.54	176.14	.9008
Sechelt	2 77 1300	51.12	51.12	1.0000
Mountain	0 77 1400	13.21	11.90	.9008
N Shore	0 77 1500	147.72	133.07	.9008
S Van Is	0 77 2100	161.53	159.33	.9864

Printout II—Predicted Load for Three Sub-Areas

Location	Code	Forecast Raw	Forecast Fitted	Factor
Total	1 78 1140	59.63	47.23	.7920
Richmond	0 79 1141	37.51	31.44	.8382
Indrl-LAF	2 79 1142	7.43	7.43	1.0000
Indrl-SID	2 79 1143	8.36	8.36	1.0000
Total	0 78 1150	233.82	185.19	.7920
Lougheed	1 79 1151	0.0	0.0	.7385
Horne Payne	0 79 1152	184.78	136.46	.7385
Newell	0 79 1153	65.97	48.72	.7385
Total	0 78 1160	80.84	64.03	.7920
Barnard	0 79 1161	68.49	64.03	.9349
Coquitlam	1 79 1162	.....	.....	.9349

Printout III—Coincident Loads Predicted by Computer

Location	Bus	Coincident Loads Mw	Mvar	Mva	Year
Indrl-SID	60	4.35	2.11	4.83	1958
	60	7.81	3.78	8.68	1959
	60	7.81	3.78	8.68	1960
	60	7.81	3.78	8.68	1961
	60	7.81	3.78	8.68	1962
	60	7.81	3.78	8.68	1963
Horne Payne	60	83.55	40.46	92.83	1958
	60	91.03	44.09	101.14	1959
	60	97.13	47.04	107.92	1960
	60	106.74	51.70	118.60	1961
	60	116.81	56.57	129.79	1962
	60	127.54	61.77	141.71	1963

obtained directly as a result of the correlation process. Printout I shows these predictions for one year. The first digit of the code column indicates the type of projection: 0 for historical growth; 1 for selected percentage growth; and 2 for future load steps specified. The Forecast Raw column shows the results of the least-square line load projection; the Forecast Fitted column shows the predicted load after correlation.

Printout II shows the load predictions for three sub-areas. Substation loads within these sub-areas are scaled so that their sum equals the appropriate sub-area load (Code 78). For example, in the case of Lougheed, Horne Payne, and Newell, the required fitting factor to equate their sum to the total is 0.7385. No load predictions are shown for Lougheed, which is a planned new substation. LAF and SID, code names for two industrial users of bulk power, illustrate the use of code 2. This allows the sales department to estimate a demand without being scaled.

Coincident load figures produced by the computer for two substations are shown in Printout III. These are obtained by dividing the coincident forecast, in terms of generation, by the loss factor of 1.07 to give units of coincident Mw consumed by the loads. Mvar and Mva figures are calculated using a 92% power factor for 4-kv buses and 90% power factor for all other cases. The program can be adapted easily to suit changing conditions by inserting different loss and power factors.

By dividing the coincident Mva and the load by the coincidence factor applicable to the more recent year of record (0.960 in this instance), a set of load predictions is obtained for general planning purpose in terms of non-coincident Mva at the load. These results for three substations are shown in Printout IV under the column heading Load Mva.

As a guide to the rate of growth at various locations within the system, percentage load growth is obtained from the raw individual projections, as shown in Printout V. These calculations reveal the wide variations in the rate of growth throughout the system. They show that it would be unwise to apply an arbitrary overall system growth figure to every station on the system. They also demonstrate the advantages of the detailed analysis performed by the program.

Planned transformer capacity for the next six years is used to estimate firm substation capacity in Mva. Where only one transformer is installed, the capacity of a mobile transformer or other available spare is used. These firm capacity figures are shown under the Firm Capacity heading in Printout IV. Several plans for substation additions can be checked out if desired.

Excess or deficit in firm capacity is calculated for each 12 and 4-kv bus and substation by subtracting non-coincidental Mva from the appropriate firm capacity available. In cases of customer-owned transformers, the firm capacity, excess and deficit columns are left blank. Planned new substations are flagged by showing zero load and an excess of capability equal to their firm capacity.

Deficit and percentage deficit columns highlight the spots where existing transformer continuous or short-term ratings are inadequate. The tabulations show where additional substation capacity should be considered and where feeders should be cutover from overloaded buses to adjacent substations.

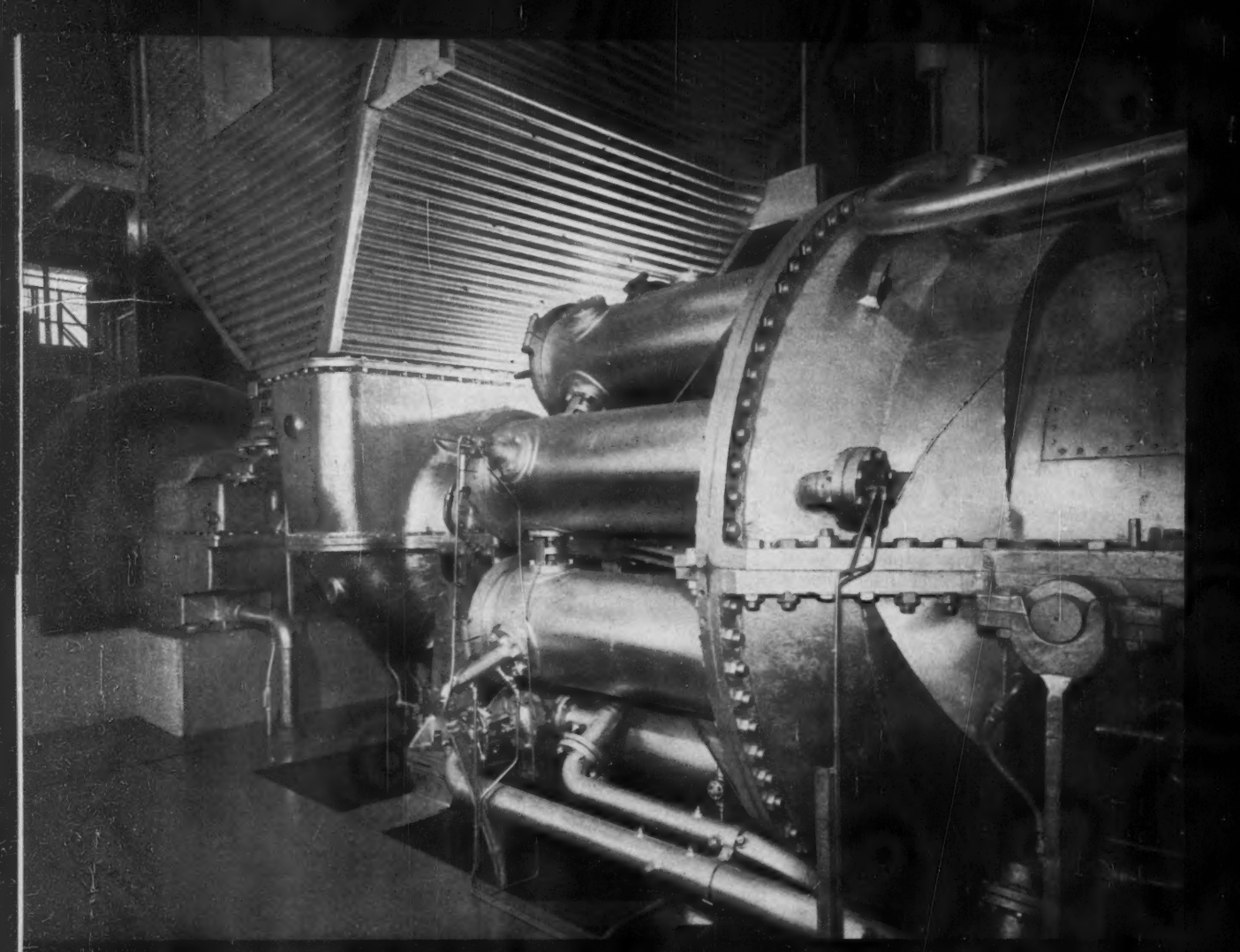
Printout IV—Non-Coincident Mva at the Load

Substation	Bus	Firm Capacity	Load Mva	Excess	Deficit	%	Year
Indrl-SID	60	.....	5.03	.....	....	....	1958
	60	.....	9.04	.....	....	....	1959
	60	.....	9.04	.....	....	....	1960
	60	.....	9.04	.....	....	....	1961
	60	.....	9.04	.....	....	....	1962
	60	.....	9.04	.....	....	....	1963
Lougheed	60	42.00	0.0	42.00	....	....	1958
	60	42.00	0.0	42.00	....	....	1959
	60	42.00	0.0	42.00	....	....	1960
	60	42.00	0.0	42.00	....	....	1961
	60	42.00	0.0	42.00	....	....	1962
	60	42.00	0.0	42.00	....	....	1963
Horne Payne	60	132.00	96.70	35.30	....	....	1958
	60	132.00	105.35	26.65	....	....	1959
	60	132.00	112.42	19.58	....	....	1960
	60	132.00	123.54	8.46	....	....	1961
	60	132.00	135.20	.....	3.20	2.42	1962
	60	273.00	147.61	125.39	....	....	1963

Printout V—Annual Raw Percentage Growth

Location		Raw Growth %
System	Tl	9.6
Mainland	Tl	9.6
Island	Tl	10.1
Burrand	Tl	8.2
Fr Valley	Tl	16.4
Schelt	Tl	*
Mountain	Tl	15.8
N Shore	Tl	16.7
Downtown	Tl	5.7
Murrin	60	−3.1
Murrin	12	−3.7
Murrin	4	−2.7
Dal Grauer	..	30.5
Pt Grey	Tl	6.2
Sperling	60	3.0
Sperling	12	−3.9
Sperling	4	5.8
Geo Dickie	..	11.0
Marpole	Tl	12.0
Kidd 1	60	9.5
Kidd 1	12	11.0
Kidd 1	4	8.6
Lulu	Tl	*
Richmond	..	14.5
Burnaby	Tl	9.6
Horne Payne	60	13.7
Horne Payne	12	9.7
Horne Payne	4	16.6

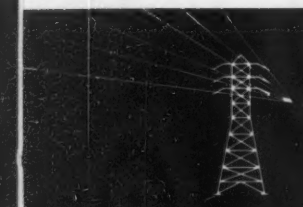
* Insufficient past records.



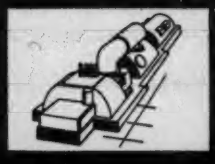
PEAK LOAD CAPACITY is being provided by General Electric gas turbines like this 10,000-kw unit with demonstrated record of starting, operating reliability.

This General Electric gas turbine experience record can assure you of reliability for your '61 peak loads:

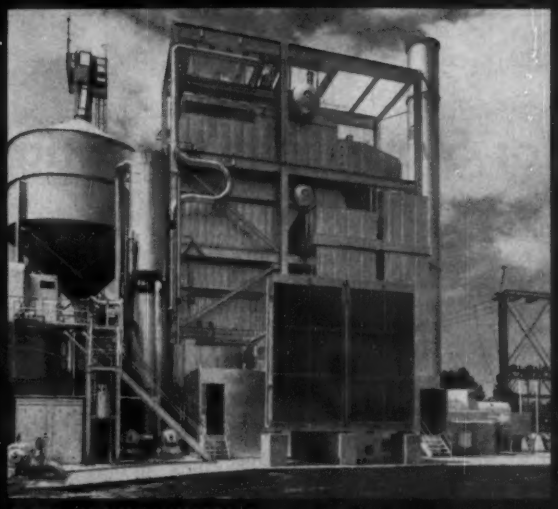
200 operating gas turbines
1,200,000 installed kilowatts*
4,000,000 hours, or
450 machine-years of operation



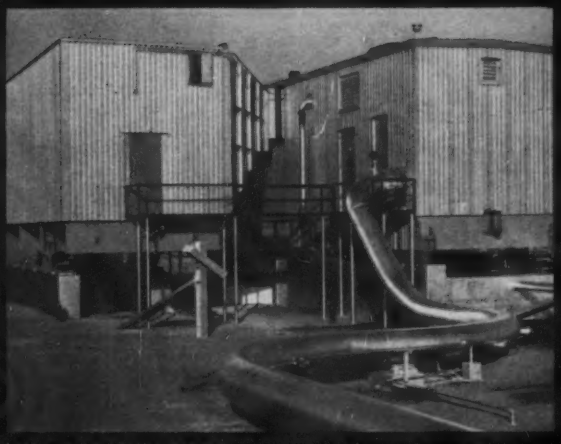
General Electric Turbine-Generators Help Keep Power Costs Low



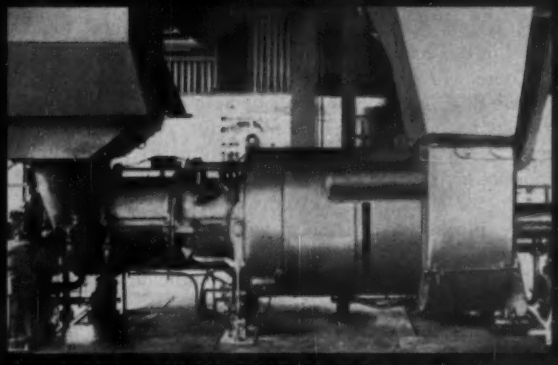
Large steam turbine-generators for base load— 100,000 kw and up



PLANT EFFICIENCY IMPROVED more than six percent over a conventional steam station with this 5,000-kw gas turbine operating in the first combined gas-steam turbine utility plant.



ON THE ARABIAN DESERT, six unattended pipeline pumping stations powered by reliable General Electric gas turbines are being radio-controlled from fifty to one hundred miles away.



IN A PROCESS CHEMICAL PLANT, this G-E gas turbine operated continuously for 13,178 hours, or nearly 18 months, before maintenance requirements of process equipment dictated a shutdown.

FOUR YEARS OF PEAK-LOAD SERVICE crammed into each month — that's the equivalent in peak load service of these General Electric gas turbine-electric locomotives which start 400 times each month.

You can apply General Electric gas turbines to peaking service with assurance of reliable performance. The highlights of the unequalled General Electric gas turbine experience record are reflected in the figures above.

Additional proof of reliability includes these facts:

- thirty-two General Electric gas turbines have operated over 230,000 hours in electric utility applications including peaking, end-of-line, and base-load service;
- a study of all General Electric gas turbines in high-use-factor service (50 units) reveals an average of 98% availability and 99.5% reliability with many of the units having been in service since the early 1950's; and
- ten units are now in service with over 50,000 hours of operation, 35 units with over 40,000 hours and 64 units with over 30,000 operating hours.

And these remarkable records have been set under some of the most severe operating conditions—some of which are shown in these illustrations.

Reliable General Electric gas turbines—available in a wide range of sizes—are the *economical* answer to your peak generation needs.

FOR INFORMATION about the application of General Electric peak load gas turbines on your system, call the G-E sales engineer in your area, or write for Bulletin GED-3761. General Electric Company, Schenectady 5, New York. 247-40

*Equivalent KW

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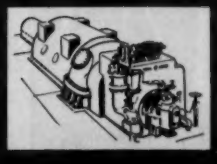
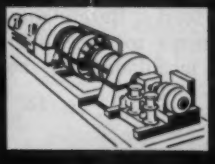
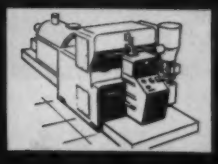


Medium steam turbine-generators for base load—100,000 kw and down



Gas turbines for peaking, combined steam-gas cycle, and base load



Mechanical drive steam turbines for boiler feed pumps and other auxiliaries

Resistor Stops Static During

W. L. NUHFER, Chief Electrician, Cabin Creek Plant, Appalachian Power Co, Cabin Creek, W. Va.

Annoying or hazardous "static" voltage can be reduced to an insignificant value during testing of high-voltage breakers by inserting a resistor between the bushing and ground. This method does not interfere with the normal test procedure and does not require the bushings to be disconnected. However, it is not intended to replace standard grounding procedures.

The resistor is used only during that part of the test when one ground is removed to allow the adjustment of breaker contacts. This method should be used with care when there are storms in the area, or switching operations on a nearby system when contacts are being adjusted.

The resistance to be inserted between the bushing and ground should be just enough to prevent audible indication that breaker contacts are open, but small enough to drain off the static charge. Limits for this resistance should be determined as a preliminary procedure. When a buzzer is used to indicate when breaker contacts are touching, the minimum resistance may be found by connecting the buzzer through a variable resistor and adjusting the value of resistance so that the buzzer will start to operate. Then increase the resistance until the buzzer stops. Calculate the ohmic resistance of this later value.

To allow for new batteries and for other circuit variables, select a value 30-50% above this figure for the minimum resistance. For example, if the buzzer operates through 10 ohms and stops operating at 15 ohms, a minimum resistance of 20 ohms would keep the buzzer from ringing all of the time.

To find the maximum value of resistance, tests were conducted on a 345-kv OCB with its bushings connected to 224 ft of open bus lead paralleling an energized circuit. Using a Simpson Unimeter, voltages found between the bushing and ground are listed in the accompanying table.

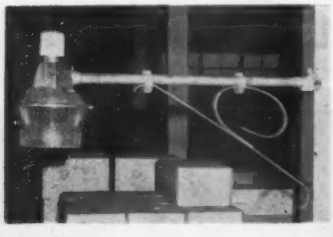
These voltage readings verify that a resistance of less than 1,000 ohms will be safe for 345 kv for the above conditions. To allow for possible variables, such as longer exposed conductors, different conductor clearances, or questionable weather, a resistor of less than 500 ohms should be used. For safety purposes, resistance values near the lower end of the workable range are preferable.

Because the above test findings indicate a work-

Cut Old Bracket for New Luminaire

H. H. BIVENS, *Storeroom Supervisor, Appalachian Power Co, Welch, W. Va.*

Surplus pendant-type mounting brackets from older street lights may be easily salvaged for use with the newer rural/suburban dusk-to-dawn lights. Since salvage value is negligible, the slight modification of the brackets can save about $5 per unit compared with the new brackets.



Fortunately, the older brackets have the same size of pipe (1¼-in. diameter) as that required by the dusk-to-dawn luminaires. For conversion to a straight slip-fitted bracket, the gooseneck end of the bracket is cut with a pipe cutter (just before the bend). Bracket length can be kept close to the recommended 4 ft. No adapter is needed because the standard dusk-to-dawn luminaire clamps directly onto the 1¼-in. pipe.

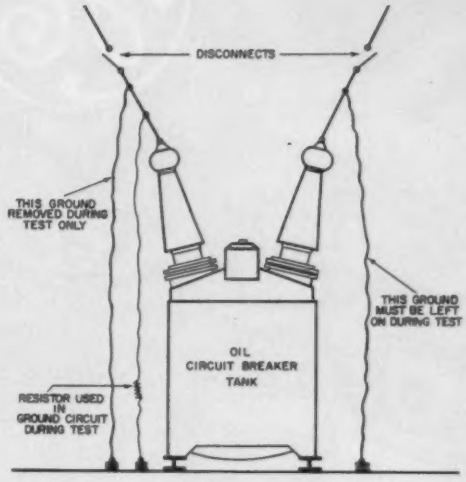
Labor required is about 15 min per bracket. The pipe end should be filed or beveled slightly to remove any burrs to prevent injury to the worker during handling, or damage to street-light cable during installation. If the galvanizing coating on the older steel bracket has become defective, stainless steel paint could be applied for additional protection.

OCB Tests

able range from 20 to 1,000 ohms, resistances from 20 to 100 ohms would be preferred. Tests made using a 138-kv breaker indicated a similar safe range of resistances, except that the high end of the range could be extended.

Based on this information, currents through the resistor will be less than 0.002 amp. Therefore, a resistor of low wattage rating will be adequate to carry the load. However, for adequate safety, a wire-wound resistor of at least 50 w, or even 100 w, is suggested. A 100-ohm, 50-w wire-wound resistor has proved satisfactory for testing both 138-kv and 345-kv OCB's.

An alternate method of avoiding the contact shunting effect of safety grounds on some OCB's is to place identical fiber insulating boards on both lift-rod contacts of the OCB pole and connect the buzzer across the individual interrupter contact. However, before the OCB is closed with these insulating boards installed, the interrupter moving-contact position must first be established with the OCB latched closed. This reference position must not be exceeded when using the fiber boards, because the boards decrease the distance the lift rods need to travel in order to close the oil circuit breaker's contacts.


DISCONNECTS
THIS GROUND REMOVED DURING TEST ONLY
THIS GROUND MUST BE LEFT ON DURING TEST
OIL CIRCUIT BREAKER TANK
RESISTOR USED IN GROUND CIRCUIT DURING TEST

Tests Determine Maximum Value of Grounding Resistor

Scale	Reading	Resistance	
5,000 v	3,500	5 megohm	(1)
1,000 v	off-scale	1 megohm	(1)
2.5 v	1.8 v	937 ohm	(2)
2.5 v	0.75 v	413 ohm	(2)
2.5 v	0 v	19.8 ohm	(2)

(1) Internal resistance of the instrument.
(2) Equivalent resistance with an external resistor paralleled with the instrument.

Connect Thermocouple Firmly to Burner Tip

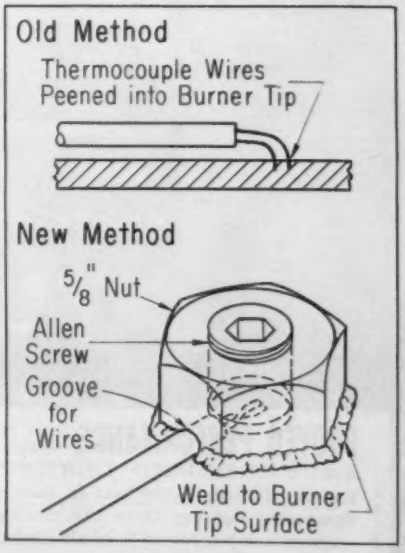
H. C. ELLER, Results Engineer,
J. B. STEWART, Instrument Maintenance Man, Clifty Creek Plant, Indiana-Kentucky Electric Corp, Madison, Indiana

Ends of delicate thermocouple wires may be connected securely and easily to burner tips by means of a nut used with an Allen screw. This scheme, devised by the authors, eliminates the possibility of the wires being broken during maintenance work and saves the subsequent time and labor needed to re-connect them. It is expected that this scheme will save over 100 man-hr per year.

In the past, thermocouple wires were inserted into $\frac{1}{16}$-in. holes drilled in the burner tips. Then the metal around the holes was peened to hold the wires in place. This method resulted in a fragile junction for the wires.

Peening the wires is eliminated through the use of a $\frac{5}{8}$-in. nut welded to the surface of a burner tip. A notch, large enough for the wires, is filed on the underside of the nut before welding. After the wires are inserted, an Allen set screw is screwed into the nut and tightened down to hold the wires firmly in place.

Based on over nine months of experience, this scheme is enthusiastically recommended. Changeover to this practice may be made conveniently during boiler outages. Estimated one-time overall cost for revising the thermocouple connections on six boilers (84 connections) is 72 man-hr plus $25 for materials.



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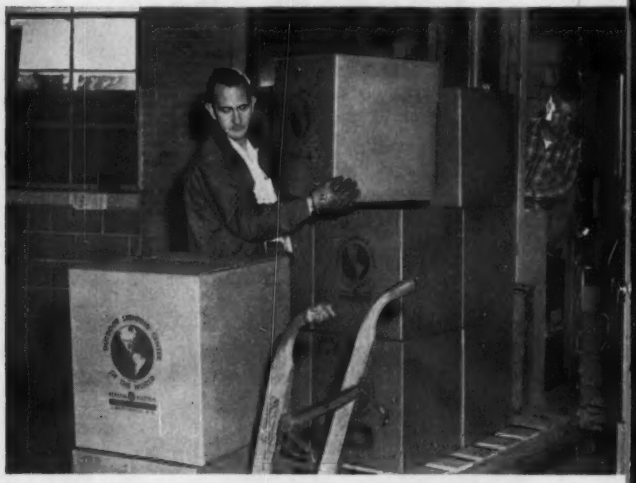

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Specify Ratio Correction CT's

A. J. McELROY, Research Section,
A. POLITIS, Relay Section, Electrical Engineering Div, American Electric Power Service Corp, New York, N. Y.

Circumstances may require the temporary removal from service of a relay or metering current transformer. If a replacement with proper current ratio is not immediately available, it may be possible to use a current transformer of another ratio and connect to its secondary an auxiliary CT to obtain the desired over-all ratio.

A simple procedure may be used to find the various possible combinations of auxiliary CT ratios and connections that can be used.

Procedure:

1. Let the ratio of an available (main) CT be represented as a:1 = Pri. current rating:Sec. current rating.

2. Let the desired over-all ratio be represented as d:1 = Pri. current rating:Sec. current rating.

3. Define ratio correction factor

$$K = \frac{a}{d}$$

4. A simple two-winding or auto-CT whose primary to secondary ratio (including tap combinations) is K could serve to obtain the desired ratios. The ratio K:1 may not, however, be available.

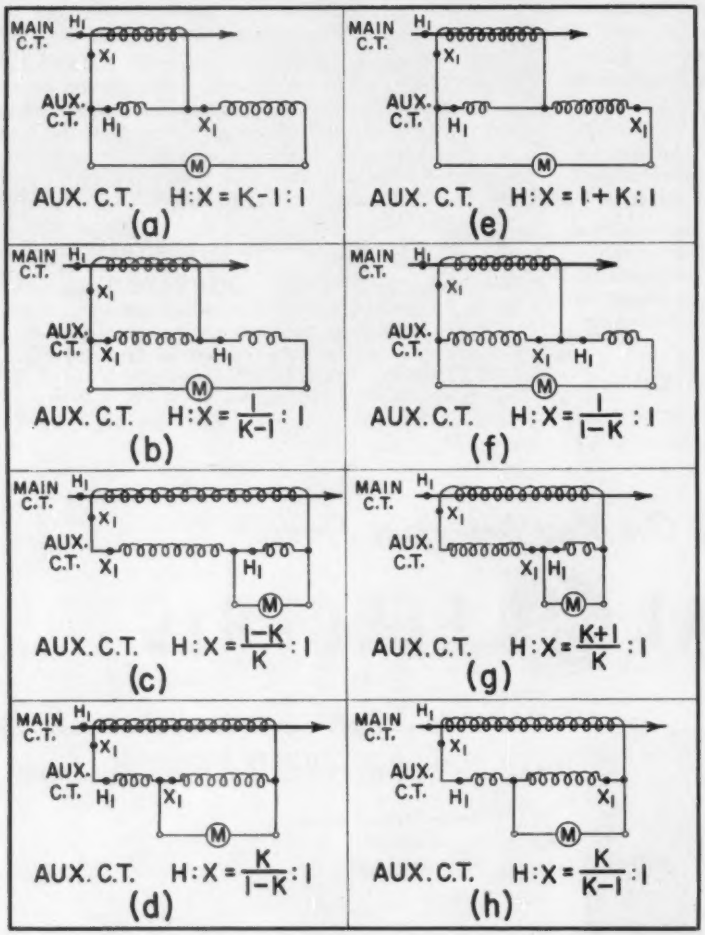
5. If a simple two-winding or auto-CT of ratio K is not available, then a two-winding CT connected as an autotransformer can be used. For a particular value of K, certain connections (see circuit diagrams) may be used, as specified in the following table. For each connection shown, the two winding auxiliary CT nameplate ratio H:X (primary current ratio rating:secondary current rating) is specified in terms of K.

$\frac{1}{2} \geq K > 0$ use circuit c, e, f or g

$1 > K \geq \frac{1}{2}$ use circuit d, e, f or g

$2 \geq K > 1$ use circuit b, e, g or h

$K \geq 2$ use circuit a, e, g or h



Example:

Given a 3,000:5 two-winding current transformer, how may one obtain a ratio of 3,000:4?

1. Available main CT ratio is a:1, or 3,000:5 = 600:1; therefore, a = 600.

2. Desired over-all ratio is d:1, or 3,000:4 = 750:1; therefore, d = 750.

3. $K = \frac{d}{a} = \frac{750}{600} = 1.25$

4. A simple two-winding or auto-CT with a 6.25:5 primary to secondary ratio will do the job. If neither is available, continue with Step 5.

5. Since $2 > 1.25 > 1$, the table suggests that a two-winding CT may be connected as an autotransformer as shown in drawings b, e, g or h. For each of these connections the two-winding auxiliary CT name plate ratio is:

For circuit b, $H:X = \frac{1}{1.25 - 1} :1 = 4:1 = 20:5$

For circuit e, $H:X = 1 + 1.25:1 = 2.25:1 = 11.25:5$

For circuit g, $H:X = \frac{1.25 + 1}{1.25} :1 = 1.8:1 = 9:5$

For circuit h, $H:X = \frac{1.25}{1.25 - 1} :1 = 5:1 = 25:5$

By using any one of these connections, with the proper two-winding CT nameplate ratio, the current entering the meter, relay, etc., will then be 4 amp when the line current is 3,000 amp.

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And a look inside **General Electric's potentiometric recorder** reveals how you get continuous, more reliable recordings of your process variables. Compare these important features:

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2. *Multi-point Selector Switch*

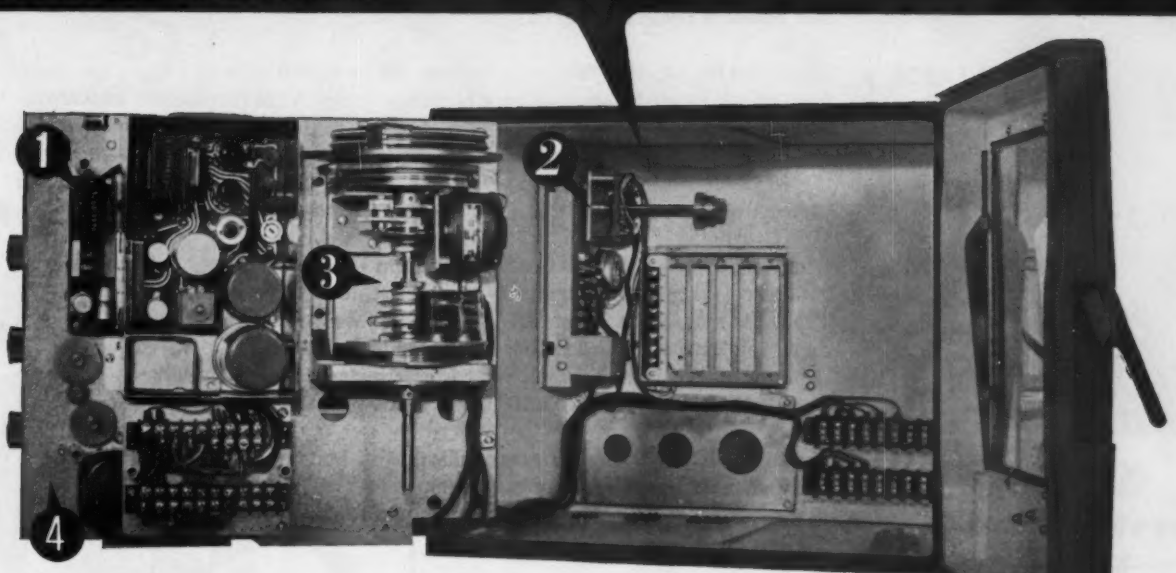
permits remote location - - eliminates long runs and multiple leads.

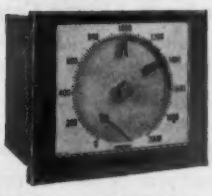
3. CONTROL SWITCHES AND SLIDEWIRES

easily accommodated - - up to 8 control or alarm switches - - up to 4 transmitting slidewires. As many as 4 switches may be adjusted by front-set index - - all switch positions independently adjustable.

4. COMPONENTS MOUNTED ON SWING-OUT PANEL

for easy accessibility include: plug-in amplifier, reference voltage unit, chart-drive motor and other measurement components.





And . . . there's a full line of General Electric recorders to choose from . . . including single-pen, two-pen and multi-point **strip-chart recorders;** plus single-pen and two-pen **round-chart recorders.**

Get the complete story on any of these recorders by contacting your nearest G-E Apparatus Sales Office today; or write for bulletins GEA-6887 and GEZ-2969, Section 599-04, General Electric Co., Schenectady 5, N. Y. In Canada, contact Canadian General Electric Co., Limited, 940 Lansdowne Avenue, Toronto 4, Ontario.

INSTRUMENT DEPARTMENT

GENERAL ELECTRIC

PRICES ▶ **General Electric withdraws published prices on large power transformers** and substitutes new "net estimating prices" which will reflect (within 5%) present selling prices. GE says present selling prices are from 28% to 38% below previous net published prices, and expects the new estimating price without further inflation "will represent selling price levels over the next three to four years."

Anticipated demand for transformers has not materialized, explains G. A. Hoyt, general manager of the power transformer department. He adds that there is extra manufacturing capacity in the industry which has resulted in severe price competition for the little business available.

The new prices, which take the place of former *net* book (or published) prices, are applicable to transformers ranging from 7,500 to 400,000 kva, including those of the Preferred Design type.

Second price increase on power capacitors in two months came in late August as General Electric Co hiked published prices 4% on its 50- and 100-kvar units. This was taken as a sign that the power capacitor prices were firming up at higher levels. GE had said earlier that it was attempting to keep the published prices at or near market-generated levels. The July rise brought 50-kvar units up to $99 a unit (EW, July 18, p 68). At that time other manufacturers said the price was still below a reasonable level.

LABOR ▶ **Word that the GE-IUE labor negotiations can be settled** without a strike has come from an unexpected source—Labor Secretary James A. Mitchell. The administration official told a Louisville, Ky, press conference that he had been informed by the Mediation Service that the negotiations could be settled without a strike. But the Mediation Service has had no official role in the negotiations, nor had GE placed its offer on the table at the time Mitchell made the observation.

STANDARDS ▶ **Standardization program at Seattle City Light** has approved 112 standard specifications covering the purchase of 928 material items since it was activated in late 1958. A total of 485 material items have been declared obsolete or put in a depletable category. Eleven City Light standards have been approved for all City departments. This was the score as Chief Engineer H. V. Strandberg, chairman of the standards steering committee, surveyed progress recently.

Six committees working for standardization in building materials, overhead distribution materials, conductor and conductor fittings, wiring materials, protective devices, and metals are on the job. A committee on insulating and electrical devices will be added soon.

COAL ▶ **The United Mine Workers Union was accused of using West Kentucky Coal Co** "as a spearhead" in a successful effort to take over the TVA coal market in an antitrust brief filed in U. S. District Court recently. The brief, filed by three small East Tennessee coal operators, claimed that the union, a heavy stockholder in the West Kentucky firm, has used it in a conspiracy to monopolize the nation's coal business.

SUPPLIERS ▶ **Several new products are scheduled for introduction by Anderson Electric Corp** before the end of the year. This was the word from R. E. Schuler, chairman of the board, and Thomas A. Fox, president, as they disclosed that earnings for the first six months of 1960 were almost triple those of the same period last year.

NOW

CADWELD

to any size

REBAR

Standard CADWELD REBAR Connections

RJ

RH

Newest addition to the famous CADWELD Electrical Connection Line is REBAR CONNECTIONS. It is generally used in reinforced concrete construction where electrical hazards must be eliminated (fuel, chemical, ammunition and electronic installations). It is also applicable to general construction where only normal grounding is required.

Adaptation of the CADWELD PROCESS for REBAR Connections was accomplished by the development of CADWELD Molds and an inert flexible packing material. This material conforms to the irregular surface of large REBAR.

Also introduced at this time is CADWELDING to Diamond Studded Steel Deck Plate.

CADWELD®

Erico Products, Inc.

2070 E. 61st Place • Cleveland 3, Ohio

Distributed in CANADA by CLM Industries—Toronto 13, Canada

Send today for your FREE BROCHURE
CADWELD REBAR CONNECTIONS

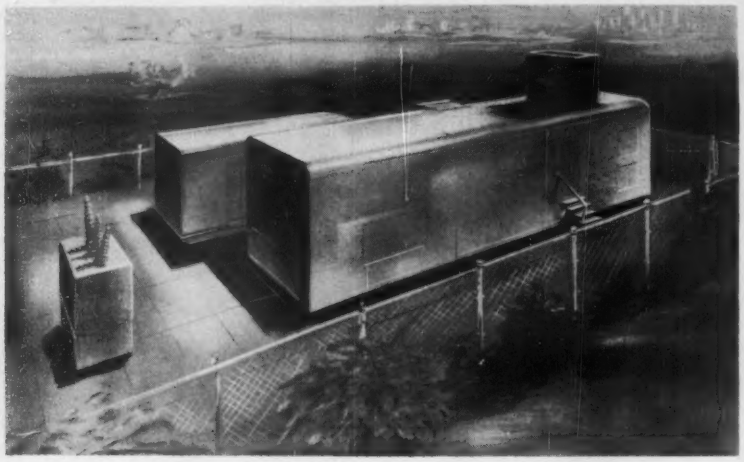
☐ Please send REBAR CATALOG
☐ Would like REBAR DEMONSTRATION

Name_____ Title_____

Company_____

Address_____

City_____ Zone____ State_____



Packaged Units Make Debut

New entries in the field of peaking-standby power units have been announced in recent weeks.

Fairbanks, Morse & Co, a subsidiary of Fairbanks Whitney Corp, drew utility interest with a display of six 2,000-kw diesel-powered, quick-start generator sets which it had manufactured under Air Force contract for the Thule radar base in Greenland.

Westinghouse Electric Corp is bringing out self-contained, automatically-controlled gas-turbine plants (see photo above) in 3,000, 7,000, and 12,000-kw ratings under the trade name ECONO-PAC.

The Fairbanks, Morse diesel plants cost the Air Force about $100 per kw. Installed cost of the Westinghouse gas-turbine plants is reported to be in the order of $80 per kw based on winter operation, or $100 per kw for summer use. Evaporative inlet air coolers can be used to maintain full generating capacity when the dry-bulb air temperature exceeds 80F. When ambient temperature is 40F and below, the output of the ECONO-PAC plant is 25% in excess of its 80F rating.

Both companies describe their units as being suitable for peaking, reserve capacity, or emergency operation.

Fairbanks, Morse said its sets are capable of delivering a full load of electric power within 8 to 30 sec after starting from a dead stop. The company said the quick-starting feature of these sets had proved to be of such interest to electric utilities that representatives of 11 utilities had visited the manufacturing plant at Beloit, Wis., to study the units during their test period.

The engines are turbosupercharged, opposed-piston diesels. The turbosupercharging makes possible delivery of large-scale power from relatively small engines.

The Westinghouse ECONO-PAC plants are said to require only a flat concrete-slab foundation approximately three ft thick, plus electrical and fuel connections. The unit can be in operation in less than two weeks after delivery to the site.

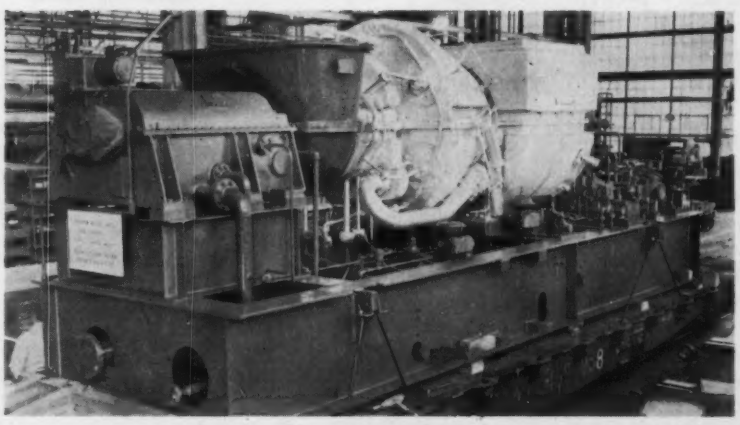
Fairbanks, Morse's six power units to be installed in Greenland can start automatically in case the prime source of power fails. The exacting military specifications called on the manufacturing firm to construct engines capable of going on full power within 30 sec, but during tests they made it in as short a time as 8 sec.

Gas Turbine Is Destined for Combined Steam-Gas Cycle

Designed for combined cycle use, this 5,500-kw gas turbine was shipped recently to the City of Austin, Minn., by Westinghouse Electric Corp. It will initially be used for peaking duty.

In two or three years, the municipality will add a 22,000-kw steam turbine to its plant, and the gas turbine will then be used as part of a combined cycle to increase the thermal efficiency of the entire installation by an estimated 5%. All auxiliaries are mounted with the turbine on the bedplate.

(*More Procurement & Products, p 54*)



JOSLYN valve arresters are REGISTERED*

*Each arrester, completely assembled, is power follow current tested at 10% above rated voltage. . . . 3, 6, 9, 10, 12, 15, 18 kv . . . with current and arrester serial number REGISTERED. The arrester is passed only if the peak recording ammeter reading is within permissible limits.

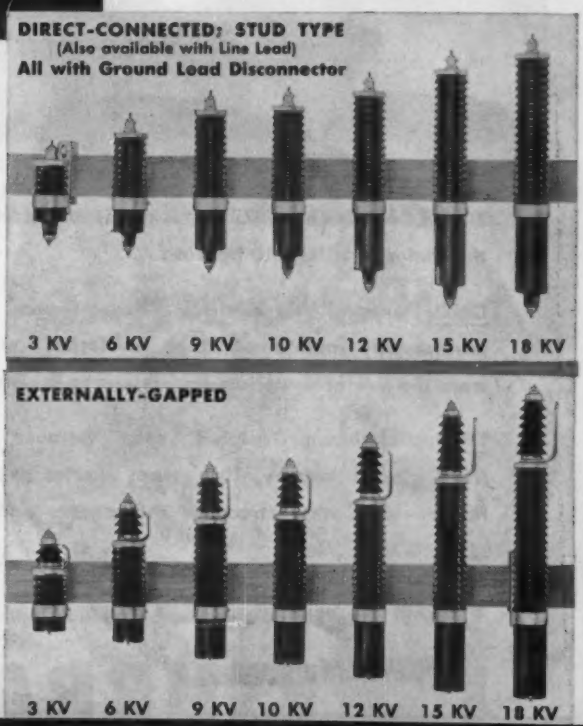
Impulse testing alone does not reveal the occasional random characteristics of silicon carbide, which could develop into failure after repeated lightning and follow current discharges in service.

Joslyn tests each arrester for its "circuit breaker" ability, utilizing the greater heat energy of follow current to determine accurately the stability of the silicon carbide.

THREE SIGNIFICANT IMPROVEMENTS JUSTIFY JOSLYN VALVE ARRESTERS

- "Micro-Pack" valve element, a special formulation of silicon carbide grains of controlled resistivity, without cement or binder, gives low discharge voltage and high thermal capacity.
- Simple, FULL CURRENT RANGE quench gap structure . . . . electrostatically shielded to obtain lowest sparkover.
- Hermetic sealing assured by means of confined neoprene gaskets under measured pressure.

SPECIFY JOSLYN VALVE ARRESTERS TO GET REGISTERED PERFORMANCE



JOSLYN COMPLETE POLE LINE EQUIPMENT ®

JOSLYN MFG. AND SUPPLY CO.
155 North Wacker Drive • Chicago 6, Illinois

NOW you can have BOTH!

THIS SPACE REPRESENTS AREA OCCUPIED BY A WOOD INSULATOR WITH ARCING HORNS

COMPARE WITH →

UNPARALLELED electrical characteristics

MINIMUM occupied **SPACE**

...if you install

HUBBARD Fiber Glass Strain Insulators

TOP CONSIDERATIONS in rating Strain Insulators dictate the choice of HUBBARD because . . .

ONE: "Unparalleled Electrical Characteristics" which mean permanently maintained, high insulation values resulting from the use of materials impervious to moisture or decay.

TWO: "Minimum Occupied Space" because *NO ARCING HORNS* are necessary. This means shorter guys, less interference with other structural components and LOWER INSTALLED COST.

BETTER PRODUCTS *through Creative Engineering*

HUBBARD and COMPANY

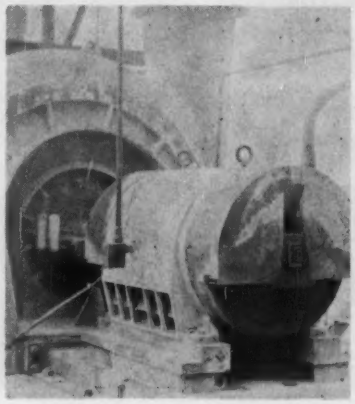
200 SOUTH MICHIGAN AVENUE • CHICAGO 4, ILLINOIS

(*Continued from page 52*)

Suction Hose Lightens Work

Lightweight flexible tubing with a "scuff strip" added for extra protection is being used by Commonwealth Edison Co for pumping water out of manholes prior to maintenance work.

The tubing was designed and manufactured by Flexible Tubing Corp of Guilford 2, Conn., working with patented Spiratube. It can be pulled in and out of a hole by one man, and can easily be stored inside the pump truck.



Epoxy Withstands Corrosion

Among the industry's first epoxy insulated form-wound motors, this Elliott Co 350-hp unit now drives a compressor in a chemical plant. Despite the corrosive chemical atmosphere and a constant spray from an adjacent cooling tower, the epoxy insulation has enabled the motor to work without electrical failure.

Truco Merges With Clute

Truck Equipment Co (Truco) became a division of the Clute Corp under a recent merger. Truco makes truck-mounted handling equipment including wire-laying trailers, aerial lifts and ladders, turret derricks, and powered hole diggers.

Truco President E. V. Garnett said the merger would enable Truco to expand its program of research, development, engineering, and manufacture.

(*More Procurement & Products, p 56*)

ALLIS-CHALMERS

Originators of 5/8% Step Regulators

Hang up the "climbers"!

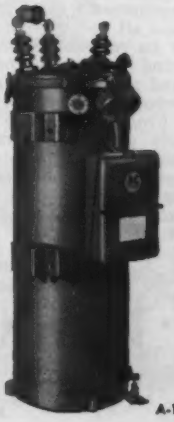
New JFR regulators offer safe, ground-level adjustment

It's standard with Allis-Chalmers! Position indicator drag hands adjust from the ground at the remote control panel. Saves poles, ends risky pole climbing and makes recording of operation range practical. At the push of a button, indicator *drag hands* are reset on large, easy-to-read face with reflecting numbers and indicator hand.

There's much more for you in this all-new design. It's the most advanced regulator on the market today. New sight indicator gives you fast check of oil level. Newly designed cover, with hidden bushing mounting studs, cuts maintenance. JFR's now lower, lighter . . . slashes transportation, handling and installation charges. Ask your nearby A-C office for new JFR bulletin 21B7977E or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.

Feather-Touch is an Allis-Chalmers trademark.

- External by-pass arrester
- Obstruction-free cover
- Electrical resettable position indicator
- Oil sight gauge
- Feather-Touch control



A-1216

Crapo

GALVANIZED STEEL STRAND HAS ALL 5

1. Strength
2. Workability
3. Ruggedness
4. Long Life
5. Economy

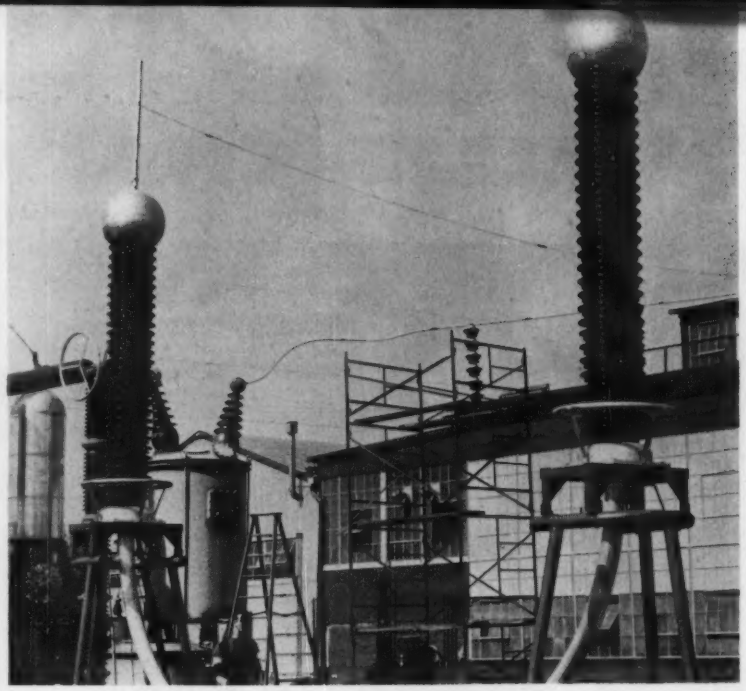
When you select a size and grade of strand for a specific job you want to know that it meets every requirement of that job. You want ample strength to sustain the ultimate load—plus an adequate safety factor. You want pliability for ease of working in the field. You want ruggedness to withstand the abuse which may be encountered during and after installation. You want long, dependable life. And, you want reasonably low first cost and low maintenance costs.

For more than 50 years *Crapo* Galvanized Steel Strand has consistently demonstrated its ability to more than meet all of these requirements. Proof of its reliable performance is to be found in the case histories of overhead power and communication lines throughout the country.

Crapo Galvanized Steel Strand is fully protected against corrosion by heavy, uniform, dense coatings of commercially pure zinc tightly bonded to the individual wires. All grades and sizes are available in A, B and C weights of coating.

For details, ask our distributor or write direct!

INDIANA STEEL & WIRE COMPANY, INC.
Muncie, Indiana



Equipment Readied for EHV Research

Newly designed potheads for terminating 345-kv underground cables have undergone preliminary tests (cut above) and are being shipped by Ohio Brass Co to the AEIC-EEI Extra High Voltage Research Project at Cornell University.

A 460-kv, 50-Mva autotransformer was recently shipped from General Electric Co's transformer department to Pennsylvania Electric Co for its EHV research project.

The Ohio Brass potheads incorporate features that permit one-day installation. Capacitors are totally enclosed within the pothead assembly and never exposed. The potheads will be used to terminate three different types of cable.

The GE transformer has 23-ft bushings (16 ft above cover), is forced-oil, forced air-cooled and weighs approximately 200 tons. The three-phase unit, rated 1,425 kv BIL, will be used to step up 115 kv to 460 kv at the Penelec 13-mile experimental line in southern Pennsylvania.

GE is presently building a 650-kv (750-kv maximum), 40-Mva power transformer for its own Project EHV. It is scheduled to be installed and initially energized at 460 kv later this year.

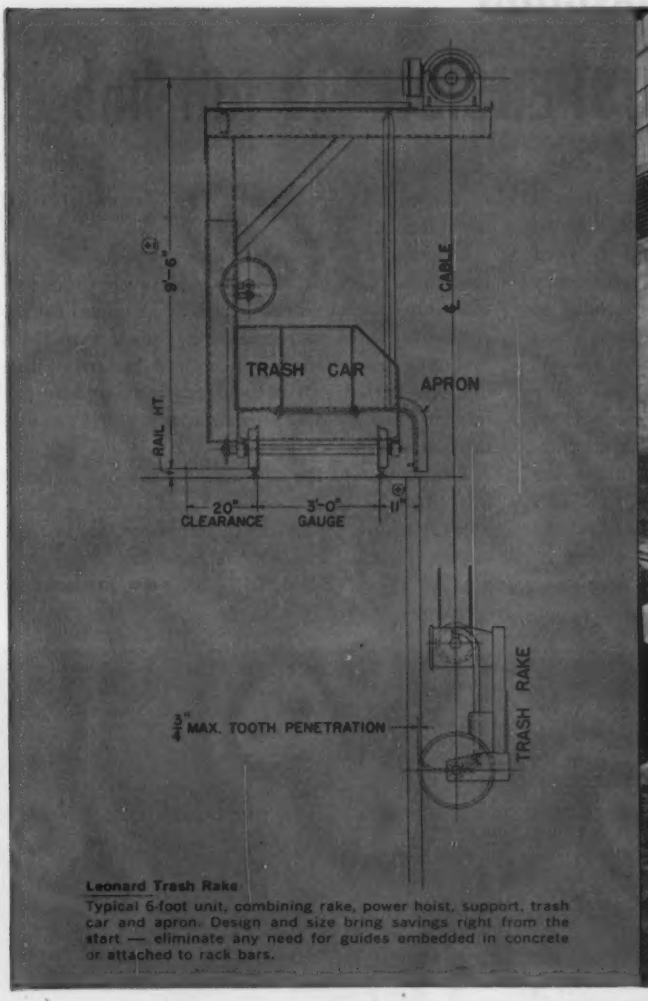
British Firms to Build Supercritical Units

English Electric Co and Associated Electrical Industries Ltd have been awarded similar contracts—each to furnish a 375-Mw supercritical turbine generator for Britain's Central Electricity Generating Board.

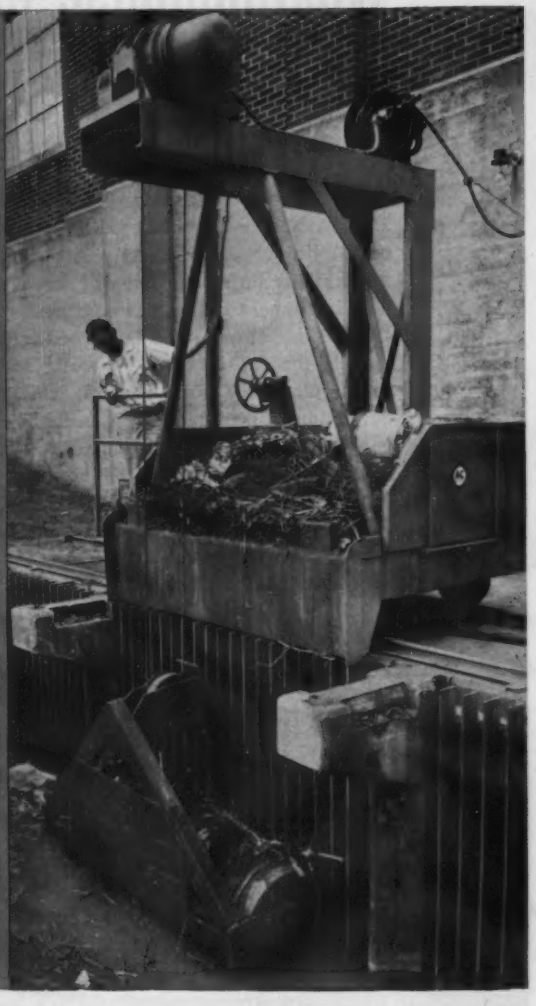
Believed to be among the largest supercritical, single-shaft sets on order anywhere in the world, the sets are for the Drakelow C Station.

The units are to be 3,000-rpm in-line sets operating with steam at 3,500 psi, 1,100F at the turbine stop valve. After passing through the high pressure cylinder, steam is returned to the boiler, reheated to 1,050F and then fully expanded in the intermediate pressure and multiple low pressure cylinders. Each 375-Mw unit comprises a multi-cylinder 3,000 rpm reheat turbine with quadruple exhaust arranged as a tandem compound unit coupled to a hydrogen/water cooled generator of the direct-cooled type. Solid couplings are employed between rotors.

ALLIS-CHALMERS



Leonard Trash Rake
Typical 6-foot unit, combining rake, power hoist, support, trash car and apron. Design and size bring savings right from the start — eliminate any need for guides embedded in concrete or attached to rack bars.



Cleans up costly head losses

. . . rakes-in savings enough to pay for itself!

Here's intake-trash removal so far ahead of hand methods that *"once sold is sold forever!" Leonard* trash rake installations deliver savings both in reduced head loss and labor costs. And they bring a permanent solution to shortages of people to do the job — make trash removal a one-man operation.

***Leonard* trash rakes roll right down your existing rack bars whether vertical or inclined. Because no channel guides are needed, they freely ride over stubborn obstructions, dig them loose, scoop trash up to the waiting receptacle or car. Self-dumping units also are available—both log-grapple and regular models.**

Leonard is an Allis-Chalmers trademark.

With Allis-Chalmers trash rakes even the initial investment is low. Width is held to the logical minimum required for adequate handling of trash . . . standard 6- and 8-foot sizes. Larger units special. Your nearby A-C representative has full details. Or write Allis-Chalmers, Hydraulic Division, York, Pa.

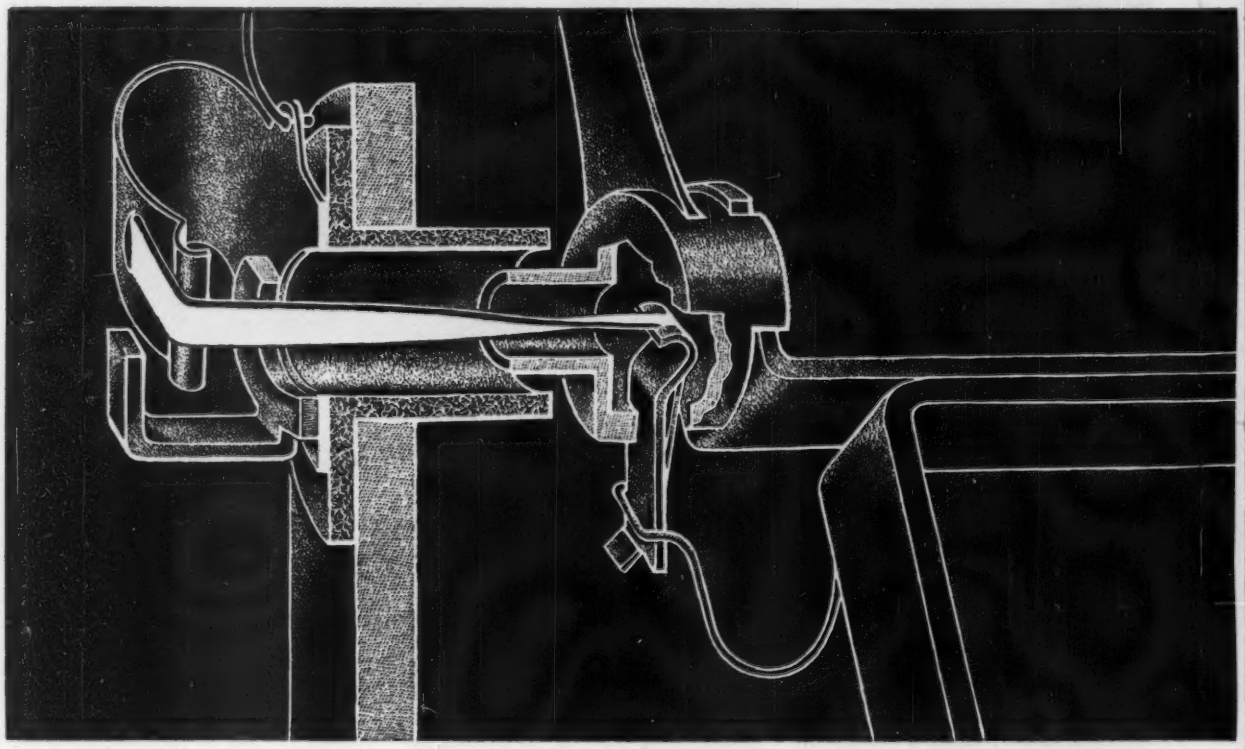
A-1307

Westinghouse extends "TAUT BAND SUSPENSION" to full line of

As a result of the outstanding performance records and customer preference established by thousands of Westinghouse TBS* instruments in all types of applications during the past year, this revolutionary new instrument design has now been extended to the full line of our switchboard instruments. These include the full-view 4½" circular scale, and 6" rectangular 100° scale designs. This remarkable development, introduced by Westinghouse in 1958, enables Westinghouse instruments to withstand extreme vibration and shock that adversely affect any other instrument. Users have found, too, that TBS offers *complete freedom from replacement of pivots, bearings and springs* . . . a significant saving in instrument maintenance costs. All types also meet or exceed ASA Specification C39.1 for switchboard instruments.

Exhaustive tests, conducted over a period of more than three years, included the most severe shock and vibration conditions that could be imagined for instruments. Field performance has more than justified our expectations. Application data derived during this period will help us continue to lead the industry in developing more accurate and reliable instrumentation for you.

Elimination of the conventional pivots and bearings provides an extremely rugged unit . . . eliminates friction . . . provides higher sensitivity . . . and results in almost infallible repeatability. For example, the Type KX-241, 250° full-view instruments



switchboard instruments

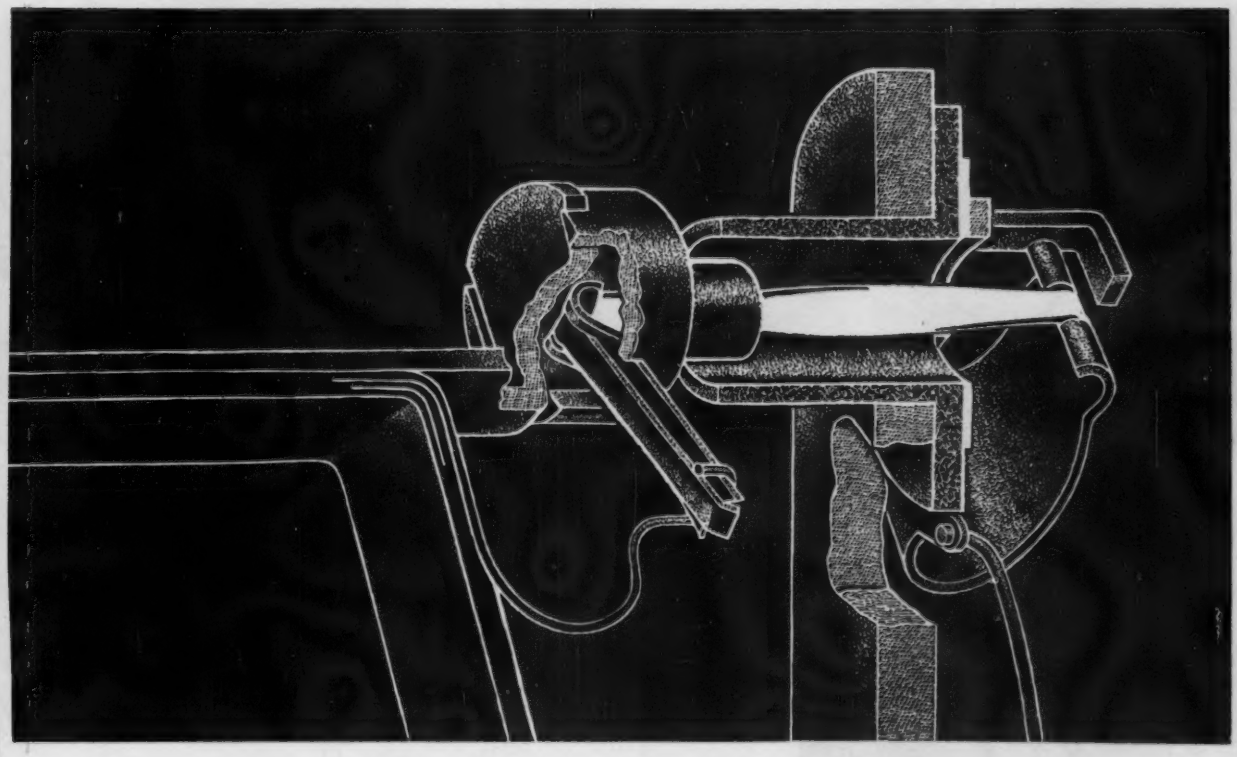
have full-scale deflection as low as 50 microamperes. Even higher sensitivities are available in the Type KX-251, 100° scale designs. These sensitive instruments will continuously withstand overloads up to 150 times full-scale deflection.

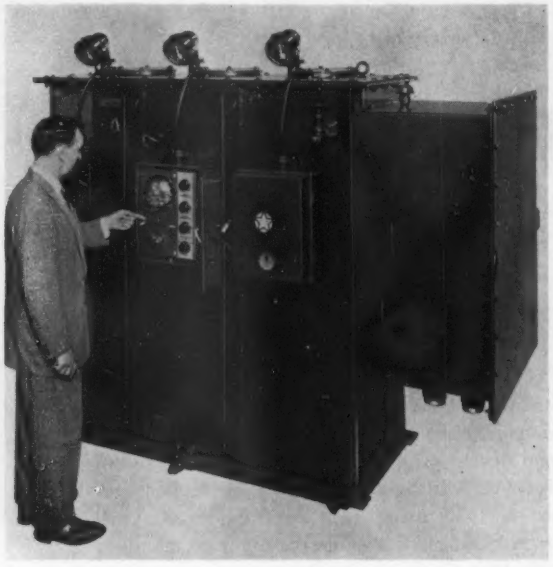
The Westinghouse TBS switchboard instrument line includes: both a-c and d-c ammeters, milliammeters, voltmeters; d-c microammeters; frequency meters; temperature indicators and ground detectors; a-c wattmeters and varmeters with Hall generator watt transducers.

Call your Westinghouse representative for complete details of the remarkably rugged TBS line. Or, write Westinghouse Electric Corporation, P.O. Box 868, Pittsburgh 30, Pennsylvania.

*Westinghouse "Taut Band Suspension"—A tough metal band about one-tenth the thickness of a human hair is the heart of the amazing suspension system developed by Westinghouse instrument engineers. All Westinghouse instruments shipped after June 30, 1960, using Taut Band Suspension will bear the trade-mark *tbs* on the dial face. J-40532

YOU CAN BE SURE... IF IT'S Westinghouse

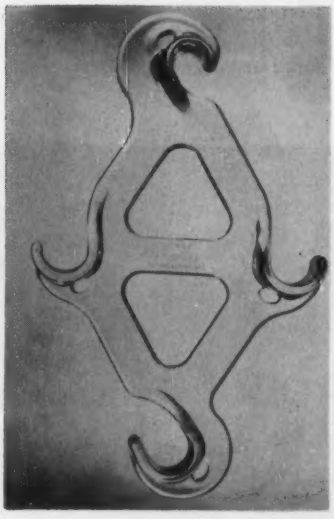




Regulator . . .

. . . combines advantages of single and 3-phase voltage regulators. The Pole Star Tri-Unit Regulator comprises three distribution-type regulators, each a fully automatic and self-contained unit, combined in a single tank. It combines independent phase regulation, as compared with 3-phase gang control, with the simplicity of a 3-phase installation.

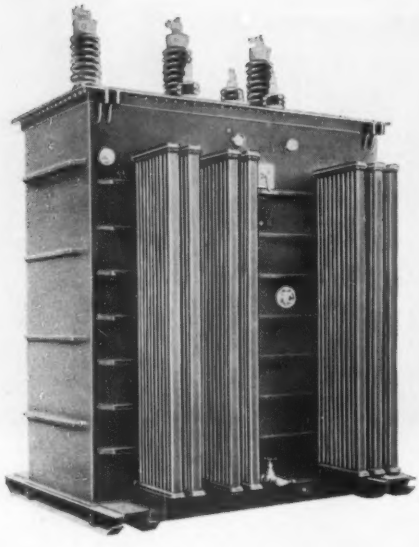
Pennsylvania Transformer, Box 330, Canonsburg, Pa.



Spacer . . .

. . . of acrylic plastic offers resistance to weathering and tracking and has low leakage and corona levels in wet weather. The single-piece spacer, 7¾x13 in., is for 5-15-kv circuits. Hung from a messenger, it will support insulated 400-MCM aluminum conductors in a 6-in. triangular configuration.

Anaconda Wire & Cable Co, 25 Broadway, New York 4, N. Y.

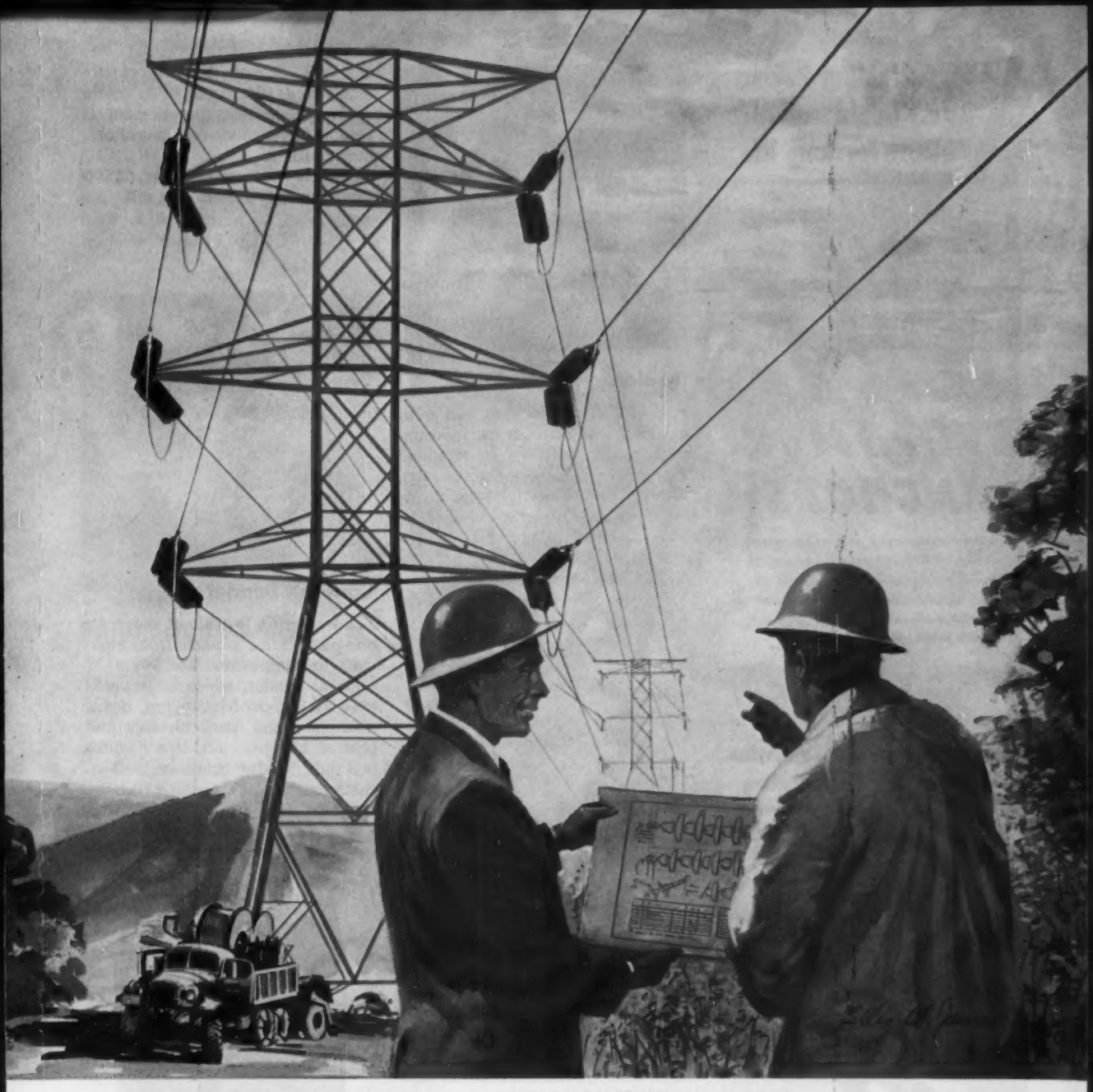


Transformers . . .

. . . of 3,000 to 7,500 kva have been added to the line of oil-immersed units. Type TLS transformers, which are for severe operating conditions, have extra heavy coil bracing. Sound levels are below NEMA standards. Insulation offers the protection of class F thermal levels while observing class A limits.

Marcus Transformer Co, Inc, Rahway, N. J.

(*More New Equipment on page* 62)



INTEGRITY

Thirty-two VICTOR No. 924, 25,000 lb. suspensions (EEI-NEMA 52-5) yoked in two strings of sixteen each, carry the strain of this angle tower of Consolidated Edison's Yonkers to Millwood, N. Y. transmission line.

Design that has been proven in thousands of installations . . . quality controlled manufacturing that maintains complete uniformity of product . . . conscientious testing procedures that insure conformance to VICTOR's high standards . . . these are the reasons for VICTOR's enviable reputation for reliability of product and integrity of purpose.

Best evidence of this integrity of purpose is the fact that VICTOR insulators consistently proof-test in excess of their EEI-NEMA ratings. You get more for your money by choosing VICTOR. For catalog, specifications and prices, contact your nearby VICTOR sales office, Victor Insulators Division, I-T-E Circuit Breaker Company, Victor, N. Y.

I-T-E CIRCUIT BREAKER COMPANY

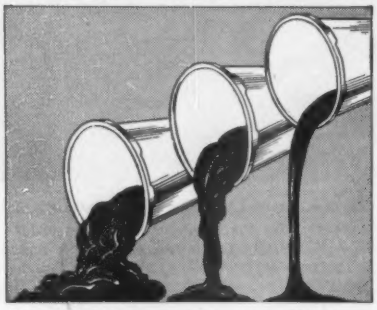
EXTRA Holding Power
QUICKLY Installed
TOUGH For long life

EVERSTICK ANCHORS

For new construction and maintenance — Everstick Anchors speed up work and provide dependable anchorage on all types of jobs. Made of resiliant, rust resistant malleable iron. The toughest anchors made. Write for bulletin.

EVERSTICK ANCHOR CO.
FAIRFIELD, IOWA

Insulating and Cable-Pulling
COMPOUNDS
of Record-Breaking Performance

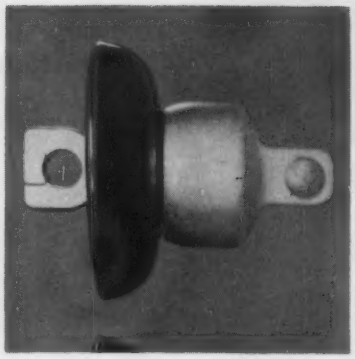


Mineralac gives you a complete assortment for every need: dense, viscous and fluid consistencies for high and low voltages in cable-joints, pot-heads, terminal bells, distribution cables, street lighting, telephone work... Insoluble in oil or water, for all temperatures. Clean, safe, economical—outranks all others in quality.

Send for new literature and prices.

MINERALLAC ELECTRIC COMPANY
25 North Peoria Street—Chicago 7, Illinois

MINERALLAC



Insulator . . .

. . . with aluminum caps and studs weighs 25% less than the same insulator with ferrous hardware and has greater resistance to corrosion. The suspension insulator for distribution lines is made in two lengths, 5½ in. (shown) and 6¼ in., for ease in working hot.
A. B. Chance Co, Centralia, Mo.

Safety Strap . . .

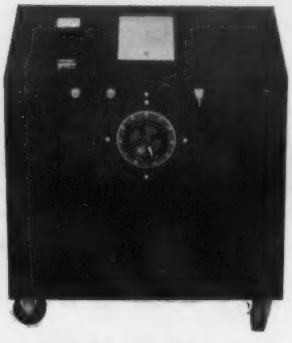
. . . for linemen is made from six-ply nylon, vulcanized for adhesion. The four outer plies are black. The inner ones are red and begin to show when the I-M strap should be replaced. The hardware is of drop-forged steel.
Atlas Safety Equipment Co, Inc, 175 N 10th St, Brooklyn 11, N. Y.

Gas Density Balance . . .

. . . for monitoring hydrogen in generators and other applications in which process stream density is critical can be panel or wall-mounted. The model 3A continuous gas density balance closely regulates its electric input to insure accuracy. Its sensitive element is mounted in a shock-resistant aluminum housing.
Beckman Instruments, Inc, 2500 Fullerton Rd, Fullerton, Calif.

Conduit Bender . . .

. . . weighs 65 lb without shoes. Its one-piece frame is made from high-strength aluminum. The No. 777 segment bender, which is powered by a 10,000-psi hand pump, bends aluminum and steel conduit and pipe of 1¼-4-in. dia. It will make one-shot, 90-deg bends in ½-2-in. conduits.
Greenlee Tool Co, Rockford, Ill.



High-Voltage Test Set . . .

. . . measures dielectric strength of transformer oil, linemen's gloves and rubber blankets, and high-pots electric apparatus. The ac tester puts out 0-40 kv and up to 0.5 amp. Motor-controlled output-voltage rise is 1,000 v per sec.
Multi-Amp Electronic Corp, Box 217, Union, N. J.

Firebrick . . .

. . . for high temperature applications is furnished in three lines. KAO-HB is for high-burn duty, KAO-60 is 60% Alumina, and KAO-70 is 70% Alumina.
Babcock & Wilcox Co, 161 E 42nd St, New York 17, N. Y.

Switchboard Meters . . .

. . . with 1% accuracy are furnished with 4½-in. square mounting flanges. Standard type AB-30 meters have normal ratings of 150 to 600 v for voltmeters and 5 amp for ammeters.
General Electric Co, Schenectady 5, N. Y.

More New Products

Low-voltage ac/dc **safety switch** for heavy duty disconnect service has switch and fuse elements mounted on a removable steel plate to make installation easy. Current ratings are 30-600 amp.—Continental Electric Equipment Co, Box 1055, Cincinnati 1, Ohio.

Line of low-voltage industrial **circuit breakers** comprises six frame sizes that replace twelve sizes. The breaker ratings are 10-800 amp and interrupting capacities are 5,000-50,000 amp.—Westinghouse Electric Corp, Box 2099, Pittsburgh 30, Pa.

Compact size 5 **magnetic starter** has a depth of 6⅛ in. and fits in an enclosure 8 in. deep. Contact structure minimizes heating and wear.—Cutler-Hammer, 235 N 12th St, Milwaukee, Wis.

The simplified switch driving mechanism of the Delta-Star "MK-40" Switch has only three moving parts. Links, levers, and braids, which are sources of trouble both in operation and maintenance, have been eliminated.

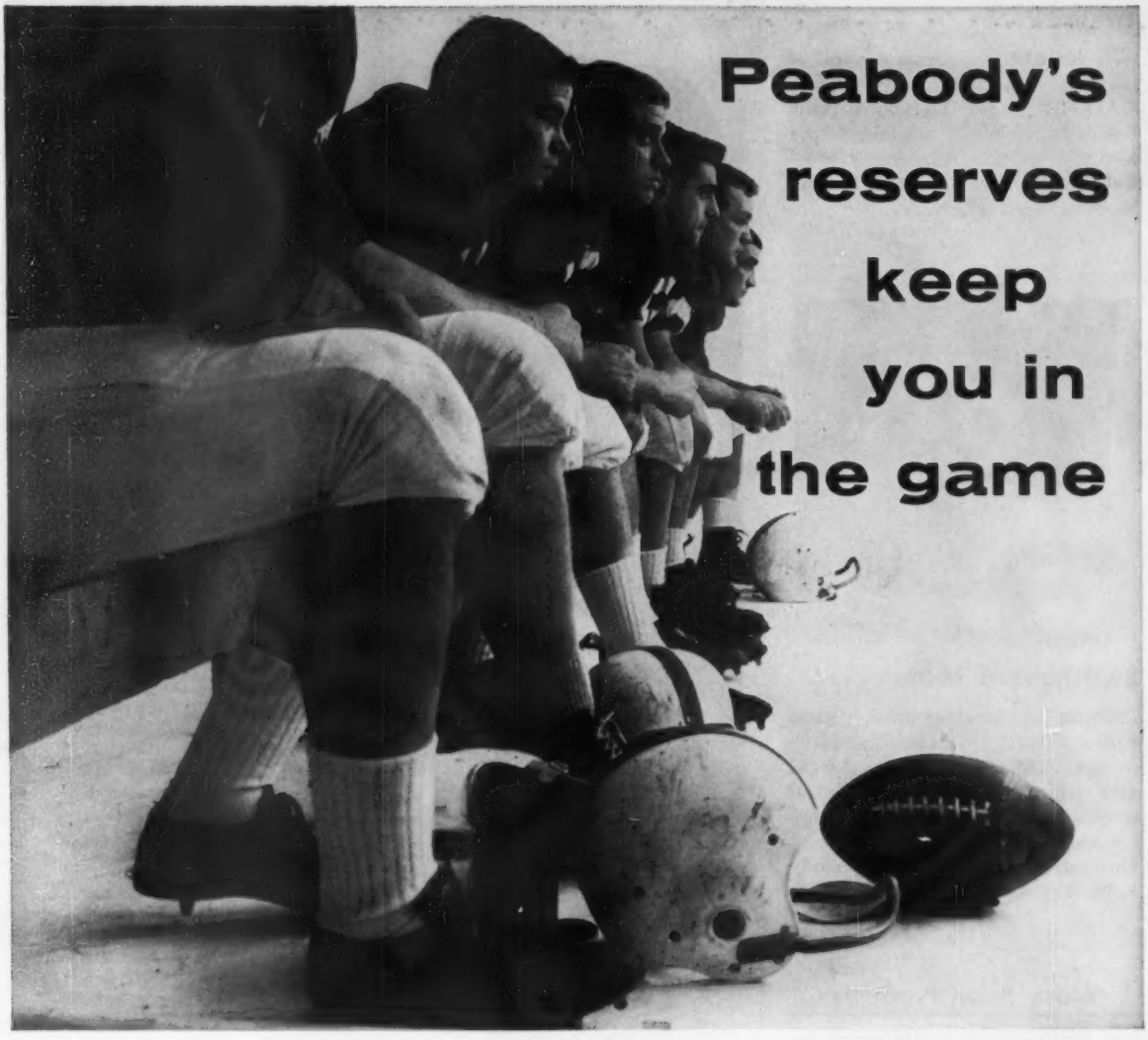
Trouble-free operation in the worst weather is assured by the "MK-40's" powerful leverage. The blade is twisted about its axis in the first 15° of rotation, relieving contact pressure. The 45° adapter gives a high mechanical advantage when it is most needed—23° of insulator rotation provides the first 10° of blade lift. Blade is under positive control during both opening and closing cycles, and locks in both open and closed positions. Factory sealed bearings require no lubrication—simplifying maintenance.

"MK-40" Switches are available in capacities from 400 to 4000 amperes—7.5 to 400 KV. For complete information, write to *Delta-Star Electric Division, H. K. Porter Company, Inc., 2437 Fulton St., Chicago 12, Ill.*

DELTA-STAR PORTER **ELECTRIC DIVISION**

H. K. PORTER COMPANY, INC.

PORTER SERVES INDUSTRY with steel, rubber and friction products, asbestos textiles, high voltage electrical equipment, electrical wire and cable, wiring systems, motors, fans, blowers, specialty alloys, paints, refractories, tools, forgings and pipe fittings, roll formings and stampings, wire rope and strand.



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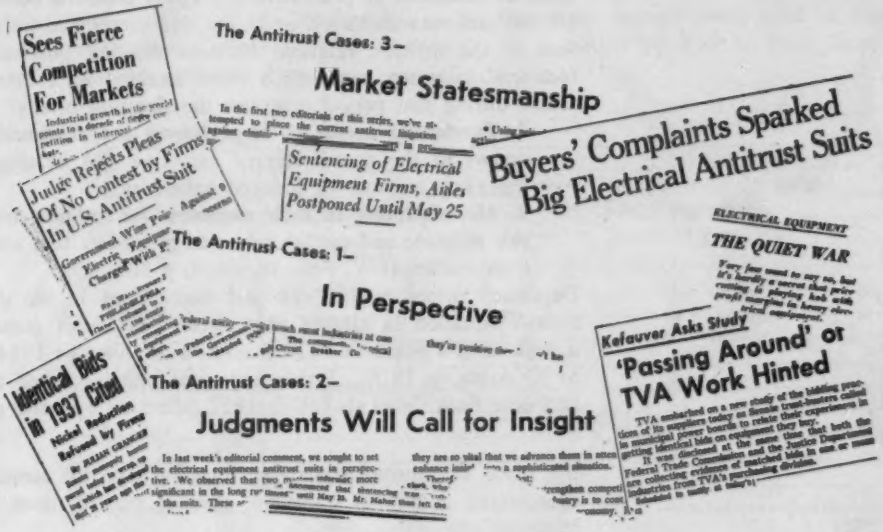
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The Antitrust Cases: 2–
Judgments Will Call for Insight

FIRST IN A SERIES OF THREE ARTICLES

Distress in Equipment Market Poses Question:

How Free is 'Free Enterprise?'

The electrical power industry of the United States is a mammoth enterprise. Last year, the power supply arm—the electric utilities—sold about $10.6 billion worth of service in the form of kwhr, and bought over $2 billion worth of apparatus from the equipment supply arm—the electrical equipment manufacturers. Obviously this is big business.

Right now the equipment manufacturers are undergoing a phase of economic distress revolving around the product lines they sell to utilities. Coupled with a poor year for the electrical appliances which some of them produce, this bodes little good cheer for the earnings which have been drifting steadily lower since World War II.

In the utility product lines, long-time buyer-seller and seller-seller relationships have been kicked out of kilter. Equipment prices are in many instances soggy. Communications are impaired. Manufacturing corporations and some of their employees are before the courts charged with violating the antitrust laws. No one can predict the ultimate effect of the court decisions on industry policies, relationships, and economics.

There is real concern expressed in many supplier quarters about dwindling earnings and what this will mean to product quality, product innovation, and capital expenditures.

Adding to the uncertainty, foreign equipment suppliers are "intruding" in the US market, and offering their wares at prices often substantially below the currently depressed domestic levels.

In putting these marketing conditions in perspective, bear in mind this is not the first price war the electrical industry has seen. Nor will it be the last. The great "white sale" of 1954-55 comes to mind first, and then the price cutting in several lines in 1958. A quick check of Electrical World files discloses that as far back as the twenties the problem of extreme price competition pervaded the industry. In the first 26 issues of Electrical World in 1928 there were some 25 mentions of price-cutting. These included editorials, letters from both utilities and manufacturers, and two- and three-page articles. Judging from the tone of the articles, relations between utilities' purchasing agents and manufacturers' salesmen were much more strained then than they are now. One article during that period describes the situation briefly:

> **1. Purchasing agents of large buyers are rigorously applying the thumbscrews** to the manufacturers' salesmen and beating down price levels by ingenious methods of induced competition.
>
> **2. Manufacturers in their eagerness for volume are weakly submitting to this pressure and cutting prices** to get orders that net a loss and demoralize their market (EW, Feb. 18, 1928, p 362).

Depressed prices in 1927-28 and fluctuations in the previous years help set today's situation in clearer perspective. Prices of standard porcelain reached a peak of 350 points in 1920 (based on an index of 1914=100) and went down to 90 points in 1927. Power apparatus prices reached a peak of 188 in 1921 and were back down to 118 in 1927 (chart on opposite page).

But while this history may throw some light on the economic situation, it leaves unanswered a host of questions growing out of more recent circumstances—questions such as:

- **How free is "free enterprise?"**
- **Are the antitrust laws necessary to keep the economy healthy and vigorous?**
- **What factors have contributed to the antitrust prosecutions and the present price situation?**
- **Is there a single prime cause for present price levels?**
- **What is needed to bring about fair market conditions?**

These are some of the questions that we will seek to answer in this series of Management Newsletters. It must be realized that some of the answers are difficult to come by. Some manufacturers' lawyers have cautioned silence during the period prior to the trials. But it is possible to collect opinions here and there, and piece them together to gain some understandable answers.

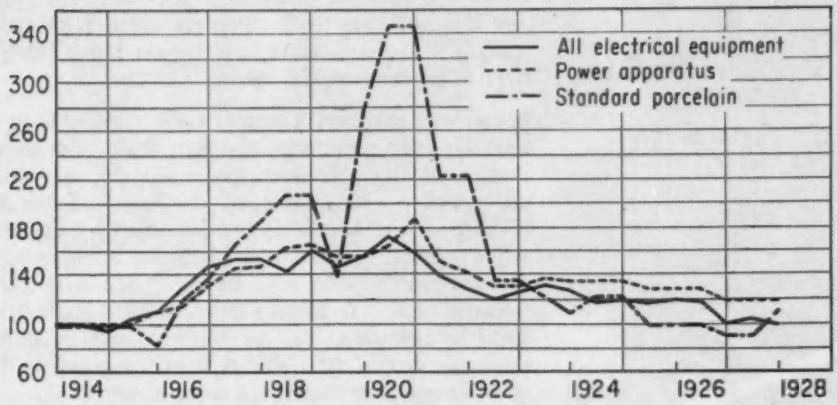
In manufacturing, comments often are loaded heavily with emotion, and must be filtered to remove ill-repressed rancor. Sometimes misunderstanding of the fundamentals underlying the industry's economic relationships is found. Fortunately there are some clear, logical thoughts expressed by intelligent individuals who are not afraid to discard the black and white of long-held dogma for the shaded greys of fact.

In the utilities, similar emotion is found, although generally to a lesser degree. Here, too, there are expressions of logical clarity. But each of the two arms of the industry tends to turn their thoughts inward, seeking justification for past approaches and present opinions. Only occasionally is there an attempt to reach a clear understanding of the position and the needs of the other.

To gain the understanding needed, it is necessary to examine the background and the fundamentals of the present situation. No claim is made here of absolute accuracy of interpretation, and no pretense is made of originality. The intent is to place as much of the thread of the fabric in full view as is practicable, and thereby to stimulate logical, calm thought processes. It is well to begin with generalities and work to the particular.

The US economic system, as it exists today, is often termed by its businessmen "free enterprise." This is lip service. The classical and pure free enterprise of the textbooks, with the untrammeled and precise workings of the law of supply and demand, has not been in action in many a year.

In the first place, there are not a very large number of uniformly-powerful buyers and a very large number of uniformly-powerful sellers in the electrical equipment market. While "monopoly" in the true sense doesn't often exist in the marketplace, "oligopoly," the domination of a market by two or three large suppliers, definitely does.



Equipment prices have fluctuated widely in the past

Further, there are differences in products within a single product line.

Next, the impact of the labor market on the economy is anything but classical. The law of supply and demand for labor was repealed by the unions sometime ago.

There are other differences between the classical concept and today's operating economy. Essentially what we have is an economy of modified free enterprise. But it has met the test of practicality. It works mighty well.

The nation has prospered under it. It is not overly difficult for new enterprisers to enter the selling market. Competition generally is keen enough to motivate product innovations and to keep the rein on production costs. Sufficient earnings over the long haul are made by the sellers to attract needed investment capital. It adds up to an industry healthy enough to support a civilian and military economy which spectacularly has increased the living standards of the US citizen to levels undreamed-of but a few decades back.

But competition is "restrained" in one or more ways in most US industries.

Sometimes it is by price and product leadership offered by large concerns dominating the market. In these cases, more often than not, smaller competitors and customers prosper, often without complaint, under this paternalism.

Often it is by technical standardization of products, usually agreed to by buyers as well as sellers.

Sometimes it is by law, as where federal statute prevents the railroads from pricing their service to meet truck and barge competition.

Sometimes it is by covert agreement among suppliers. And sometimes here there is a drift away from the basic level of business ethics prescribed by the American people to a pattern which in other parts of the world would be accepted and expected.

Are there controls sufficient to prevent abuse? Often there are. What frequently holds the business complex in balance is what has been called "countervailing powers," wielded by strong buyers who have alternatives available to them. One of these alternatives is recourse to the federal antitrust laws.

Are these laws good ones? The central statute, the Sherman Antitrust Act, was formulated in deliberately general terms. Section I says little more than "every contract, combination in the form of trust or otherwise, or conspiracy in restraint of trade or commerce among the several states, or with foreign nations, is hereby declared to be illegal. . . ." Section II says "every person who shall monopolize, or attempt to monopolize any part of the trade or commerce among the several states, or with foreign nations, shall be deemed guilty of a misdemeanor. . . ." Under this umbrella of legalistic generality, the courts have provided additional definition over the years. Pertinent to our interest, the courts have held that conspiracy to fix prices violates Section I, and this precedent has led the Justice Dept to prosecute many cases.

It has been said that it is practically impossible to prosecute the Sherman Act equitably. To some degree, it is probable that every industry in some way or another violates it in doing business under this modified free enterprise system that works so well. But it has also been said that the very "brooding presence" of the Sherman Act, taken into account by each prudent businessman in setting major policies, is sufficient to police the economy against excess and abuse. As any deterrent force, it must be exercised occasionally to remind violators of its existence. Like the hapless speeders cut down by the motorcycle cop, violators could be considered the ones unlucky enough to be caught, or the ones who were outspeeding the traffic flow to the point of danger. These arrests serve as an example to hold the flow to a safe level.

Actually, Section I in general has not been successfully prosecuted, from the standpoint of getting convictions or decrees. The really meaningful prosecutions have been the ones setting the few precedents that put teeth in the law. Thus there has been agitation for wholesale revision of the Sherman Act, spelling out in fine detail what is and what is not legal. Yet it is widely felt by businessmen that this would be a step in the wrong direction; that it would be impractical to define with equity illegal actions in a mechanism as complex as the US economy without depriving it to a large degree of the virtues that have made it so successful.

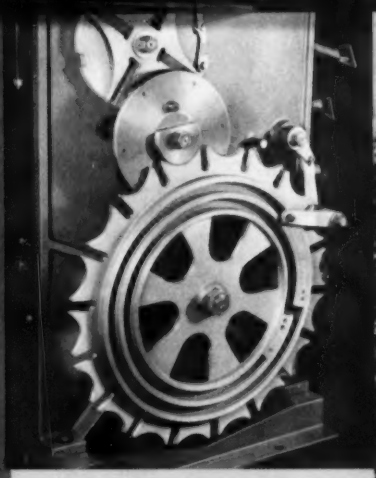
In Europe, many nations do not yet have such a legal instrument. The Germans are past masters at cartelizing. Just recently they broke up a lively price war in electrical appliances by openly and with calm deliberation moving in concert to right the stricken market. A vital problem facing the Common Market is the establishment of common antitrust laws.

The British have not had their Restrictive Trade Practises Act for very long. For many years they did not consider price agreements unethical or illegal, but they do now. Is there a coincidence that they did not execute such an about-face until their economy swung into high gear in the post World War II years? Is it possible to infer that successful maintenance of only a vibrant, growing, yet mature, economy requires a watchdog law?

In an immature economy, such as the US had just after the civil war, over-zealous restraints on business might have held back needed explosive growth.

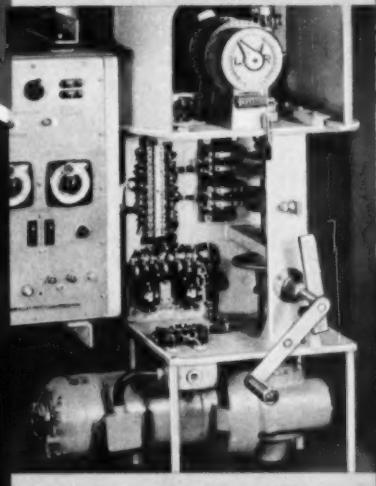
The coming of maturity and the lessening of the need for explosive penetrations may require deterrent restraint of the law to police the more steady, disciplined growth of a much larger, more inertial economy.

Second article in this series, to be carried next week, will deal with the electrical equipment marketplace. The third will offer some answers to the question, "What is needed to bring about fair market conditions?"



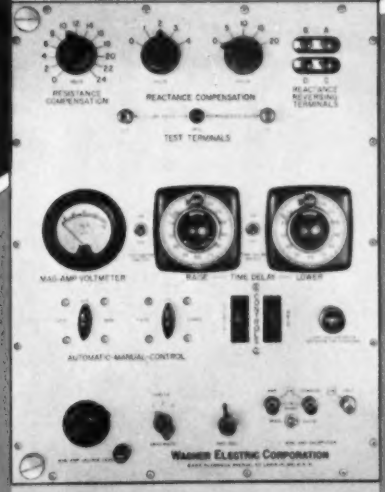
SIMPLE TRANSMISSION ASSEMBLY

The switch mechanism has only 2 Geneva gears which operate from one drive pinion. 90° entrance of the drive pinion cams cuts operating noise. There are no intermediate gears or shafts.



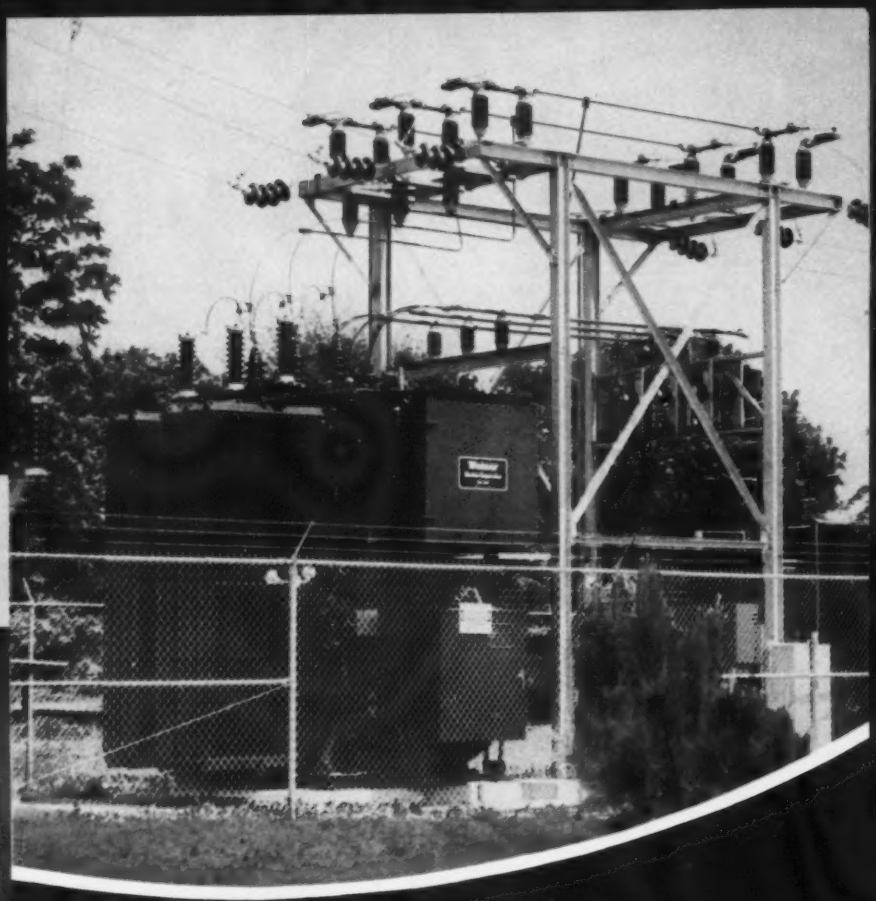
SINGLE SHAFT DRIVE

The use of only a single shaft drive and one set of miter gears to operate the switches and position indicator assures quiet operation.



MAGNETIC AMPLIFIER CONTROL

Can be set to operate at precise limits for highly accurate band width control. The elimination of moving contacts provides greater reliability.



You can provide

QUIET...TROUBLEFREE

automatic voltage regulation with

Wagner

LTC POWER TRANSFORMERS

Wagner® Load Tap Changing Transformers, with an entirely new idea behind the tap changing mechanism, offer you many advantages in automatic voltage regulation. The number of moving parts has been reduced to a minimum, and the Geneva gears are designed for 90° entrance of the drive pinion cams, to materially reduce operating noise.

The voltage sensing circuit is equipped with magnetic amplifier control to eliminate moving contacts.

Overall simplicity—in the drive mechanism, transmission assembly, switches, and control circuit—means long efficient operating life with very little maintenance.

Wagner Electric Corporation

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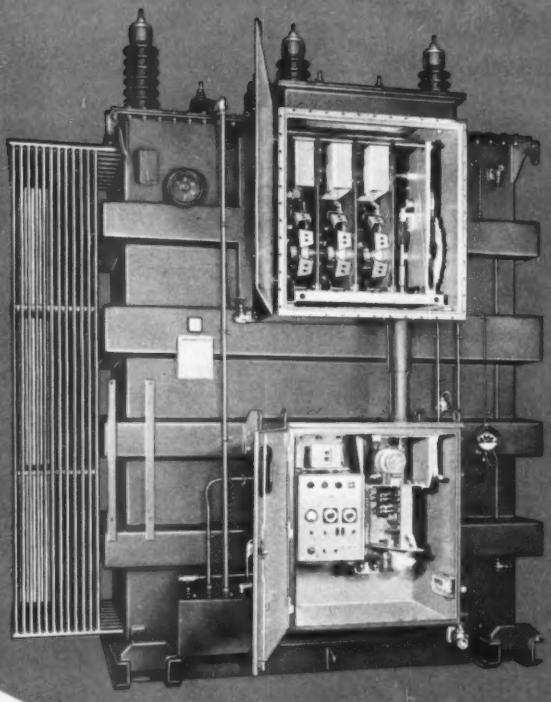


NEW SWITCH MECHANISM

The moving contacts and stationary blades of the transfer switch are made of arc-resisting material for long service life. The action of the transfer, reversing, and tap selector switches is uniformly direct and positive. The switch mechanism has great electrical and mechanical strength to operate satisfactorily under adverse conditions.

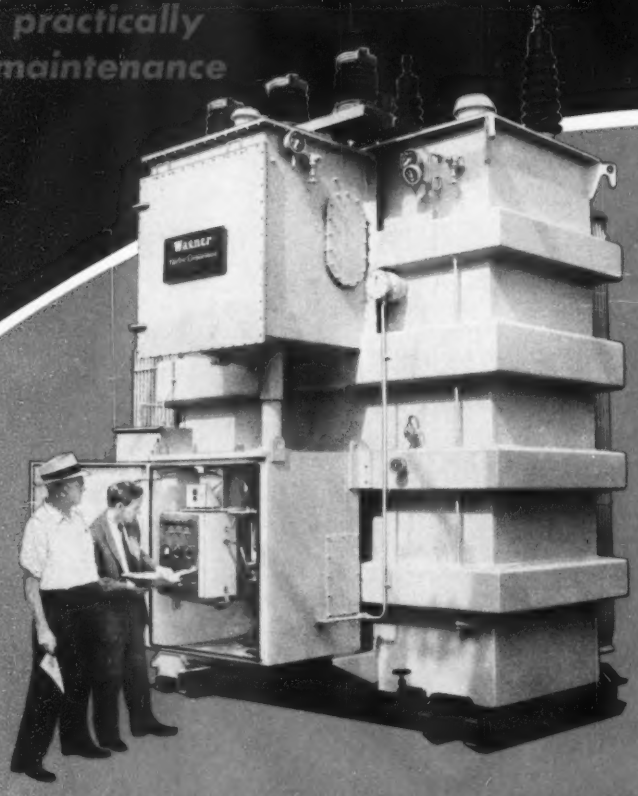
NEW CONTROL MECHANISM

Magnetic amplifier control equipment provides greatly simplified and highly accurate band width control. It will automatically initiate a tap change to regulate the load voltage in ⅝% steps over a plus or minus 10% range whenever the voltage fluctuation is sufficiently great and of sufficiently long duration. Elimination of moving parts increases the reliability of the mechanism.

Wagner® load tap changing power transformers give

LONG OPERATING LIFE

with practically NO maintenance



The unusual design simplicity of the Wagner® Load Tap Changing Mechanism provides quiet operation and long operating life with practically no maintenance beyond periodic inspection, occasional testing of oil in the switching compartment, and similar routine procedures.

Wagner Load Tap Changing Transformers can be built in all popular kva and voltage ratings to meet your requirements. Write, call, or wire your nearest Wagner branch for complete information.

Wagner
Electric Corporation
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WT60-10

CG&E Promotes Refrigerator-Freezers as . . .

'Prospectors' Pan for 'Gold'

The "prospector" reached down and picked out a "gold nugget" from the prospecting pan. "It sure looks genuine," he thought, "but I'd better have it checked over at the 'Assayer's Office.'"

The "assayer" tested the nugget, and it glowed—it was the real thing —and the "assayer" handed the prospector a "gilt-edged certificate" to certify his discovery.

Sound like a paragraph from "Sutter's Gold" or "Days of the 49ers?"

Actually this all took place many times recently in the lobby of the Cincinnati Gas & Electric Co during the utility's refrigerator-freezer promotion, "Cold Rush."

Thousands of prospectors "panned for gold" in the Cold Rush contest. *The Cincinnati Post and Times Star* ran a daily Cold Rush coupon, which readers clipped out and brought to the CG&E lobby. In all, 21,407 coupons were received in 17 days—an average of 1,259 per day.

When those bearing coupons got to the lobby they found an authentic looking prospecting camp—a mountain and a stream with running water, gold nuggets, a prospector and his trusty burro, and for a modern touch—a well-stocked freezer.

After the prospector picked out his gold nugget from the prospecting pan he went to the "assayer." The "assayer" (actually a utility sales counselor) checked the nugget by holding it under a black light. Some of the nuggets were treated so they would "glow" and when they did the holder received a "gilt-edged certificate." This certificate was actually a claim for a family-size package of frozen chili, which the contestant could pick up at a refrigerator-freezer appliance dealer.

Dealers Give Frozen Chili

CG&E sales counselors distributed thousands of packages of the frozen chili to 129 dealers. To make it easy for the contestants, the names and addresses of these dealers were listed on the back of the certificate. When the certificate was redeemed, the dealer handed the chili to the winner right out of a freezer on the floor, and it gave him a good chance to make a strong sales pitch too.

The Cincinnati Post and Times-Star, in addition to running the daily Cold Rush coupon, also featured pictures and stories during the entire promotion. The newspaper also ran a freezer supplement.

The real stars of the promotion were the gleaming new freezers and refrigerators on display in the lobby. Each unit was tagged with model number and price, along with the name, address and phone number of the Cincinnati distributor

Copy in the windows, huge ceiling panels, etc., carried out the Cold Rush theme stating, "Meals always 'pan out' with a Freezer"; "Cold discovered in Cincinnati"; "June strawberries are like gold nuggets in December"; and "Thar's cold in them thar new refrigerator-freezers."

On the opening day of the promotion, greater Cincinnatians learned about the promotion in a novel way. An "Old Prospector" complete with gray wig and beard, led a donkey through the downtown area. A sign, draped over the donkey's back, referred to the promotion and the contest.

In his journey, the prospector handed out Cold Rush cards, inviting recipient to take them to the Cold Rush Headquarters at CG&E.

The card featured an illustration of the old prospector and his burro, standing near a well-stocked freezer. On some of the cards, the food in the freezer was treated to "glow" under black light. Those who had the glowing cards received milk pitchers.

Avila Elected President of Boston Edison

CHARLES F. AVILA

Charles F. Avila has been elected president of Boston Edison Co. He succeeds Thomas G. Dignan who died July 29.

Avila joined Boston Edison in 1929 after graduating from Harvard University with a BS in electrical engineering and business administration. Prior to being named vice president and assistant general manager in 1957, he had been vice president in charge of engineering and construction. Before that he had various operating and engineering responsibilities over a number of years.

A director of the utility, he is a registered professional engineer and a member of the American Institute of Electrical Engineers.

Joseph P. Healey, vice president and general counsel has been elected to the board of directors.

Tolk Made a Vice President

Roy Tolk has been made vice president in charge of division management at Southwestern Public Service Co.

George Dupree will take on the duties of director of rates and budgets. John H. Evans has been named chief engineer, planning department.

Tolk has been with Southwestern Public Service since 1938. He was elected a vice president in 1957 handling rate and budget matters. Prior to becoming a vice president he was assistant to the executive vice president and general manager, statistical engineer, and engineer and draftsman.

Dupree has filled engineering posts in the engineering and operating departments since joining the company in 1946. For the past eight years he has been chief engineer for planning.

Evans has supervised the operation and maintenance of the company's electric transmission system and electrical maintenance of the generating stations since 1953 as senior electrical engineer, operating department.

ROY TOLK

J. C. BLANTON

Chance Promotes Blanton to VP

J. C. Blanton has been promoted to regional vice president of the A. B. Chance Co.

He has been with the firm since 1935 and has been in field sales work the past 15 years as sales representative, district manager, and, for the last six years, regional manager.

Blanton has charge of sales and warehousing operations in the North Central region, which serves utilities in Illinois, Indiana, Michigan, Wisconsin, Minnesota, North Dakota, South Dakota, and the eastern third of Iowa.

Toledo Edison Names Marshall Senior VP

William A. Marshall has been named senior vice president of Toledo Edison Co. John P. Williamson succeeds Marshall as secretary.

In his new post, Marshall's responsibilities will continue in the field of accounting and finance.

Marshall joined Toledo Edison in 1915. He became assistant secretary in 1927, secretary in 1947 and treasurer in 1949. He was elected to the board of directors in 1950 and was made a vice president in 1957.

Williamson, who will continue as assistant treasurer, will, in addition to his secretarial duties, direct methods and procedures, purchasing, and claims and real estate activities.

In the re-alignment of the company's accounting and finance department, W. R. Moran, controller, was given direction of auditing and budgeting.

WILLIAM A. MARSHALL ▶

PERSONAL BRIEFS

Consumers Power Co, Mich., has made the following appointments: **Floyd C. Fisher** to the newly-created post of general supervisor of operations research; **William C. Cooper** to succeed **Robert D. Allen,** now assistant to the president, as coordinator of consulting engineering services; **Raymond G. Thorson** to maintenance superintendent of the Dan E. Karn-John C. Weadock plants on Saginaw Bay; **William J. Gryder** has succeeded as assistant superintendent **Leland M. Hausler,** who became superintendent of the company's atomic plant under construction near Charlevoix; **James B. Falahee** to general attorney; and **Arthur J. Paul, Stuart H. Redner, Clarence E. Merritt** to senior attorneys.

James E. Kane Jr has succeeded **J. William Carothers,** retired, as Baltimore Gas & Electric Co's personnel department manager.

At Louisiana Power & Light Co: **Robert R. Jones** has been promoted to West Bank Division sales consultant; **Roland A. Gravois** became Southeastern Division sales consultant.

Harold E. Cody has been named head of Cleveland Electric Illuminating Co's newly-formed Distribution Division. **Loyd Alexander** became leader of the distribution services department, and **John Misic** and **George Yanda** were named as heads of the Miles and Brooklyn districts, respectively.

Okanogan County, Wash., Public Utility District's new chief engineer is **H. T. Brazil,** replacing **Don Gardiner** who has joined the engineering staff of the Snohomish County PUD at Everett.

Philip B. Heartt has been elected to Duke Power Co's board of directors. Three Duke Power engineers have joined Carolinas Virginia Power Associates, Inc, of which Duke Power is a member. The three—**Paul M. Barton,** who will serve as operations supervisor, and **Stanley E. Nabow** and **J. Ed Smith,** who will serve as shift supervisors—will help operate the Parr nuclear plant being built on the Broad River, near Columbia, S. C.

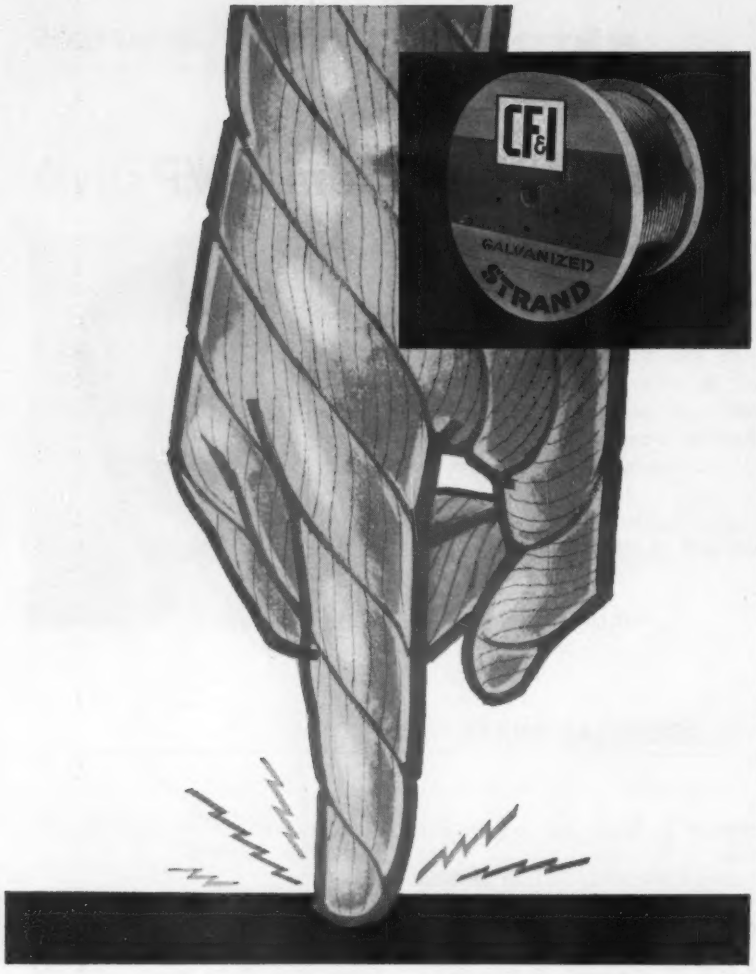
Pacific Power & Light Co has named **Roy Stephens** manager of its Lander, Wyo., office, succeeding the late **Oscar Carlson.**

John F. Mangan has replaced **Charles S. Hazen** as area engineer for the Upper Columbia Development office of the Bureau of Reclamation, in Spokane. Hazen resigned to enter private employment.

British Columbia Power Commission has made seven appointments: **John B. Hedley,** consulting electrical engineer; **Col D. C. Stephenson,** consulting construction engineer; **Eric H. Martin,** Construction Division head; **Nel A. Magrath,** Electrical Planning Division chief; **Eamon Crowley,** Program Control Division chief; **A. G. Ballantyne,** Civil Engineering Division head; and **E. G. Tallman,** Civil Planning Division leader.

D. Bruce Mansfield, executive vice president and general counsel of Ohio Edison Co, has been elected a director of the utility. **John R. Donston** has been made residential sales representative for the Youngstown Division.

(*More News About People,* p 74)



Ground
the destructive force
of lightning with

CF&I Galvanized Steel Strand

For grounding of power transmission lines, CF&I Galvanized Steel Strand has been proved by years of experience. Weldless Overhead Ground Wire Strand is made of special analysis steel to ASTM specification A-363, in three- and seven-wire constructions. It is carefully galvanized for extra weather resistance.

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In the East: WICKWIRE SPENCER STEEL DIVISION — Atlanta • Boston • Buffalo • Chicago Detroit • New Orleans • New York • Philadelphia • CF&I OFFICE IN CANADA: Montreal
CANADIAN REPRESENTATIVES AT: Calgary • Edmonton • Vancouver • Winnipeg

Robert D. Wylie has been named manager of quality control for the manufacturing department of Babcock & Wilcox Co's Boiler Division.

Walter B. Bender has joined Exide Industrial Division, Electric Storage Battery Co, as resale market manager.

Thomas R. Skidmore has been appointed a product specialist for the Hubbard Aluminum Products Division of Hubbard & Co.

Dr Van W. Bearinger has been named director of research for Minneapolis-Honeywell Regulator Co. **Dr John N. Dempsey** and **Edward E. Rexer** have been named assistant directors.

I-T-E Circuit Breaker Co has named **Dr Eugene W. Boehne** to the engineering staff as consulting engineer research and development. **Arthur G. Curtin** has been made manager-construction marketing.

Warren D. Tilton has been named vice president and general manager of the Denver Division of Hathaway Instruments Inc. **George J. Turre** has been named assistant general manager, and **Henry W. Logan,** secretary.

R. W. Beck & Associates, utility consultants, has opened a Southwestern region office in Phoenix, Ariz., under the supervision of **Gordon D. Jorgensen.**

J. Howard Holan, president of Holan Corp of Cleveland, Ohio Brass Co subsidiary, has been elected to Ohio Brass' board of directors.

Multi-Amp Electronic Corp has appointed **Ralph J. Dikeman Jr,** marketing manager.

William J. Shea has retired as vice chairman of the board of Essex Wire Corp.

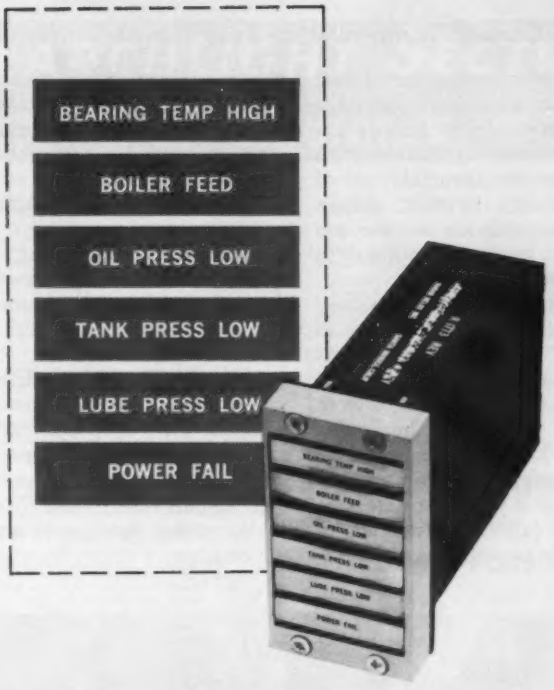
Aluminum Co of America has consolidated its research, development and sales efforts for aluminum sheet and foil strip electrical conductors with a similar program conducted by its subsidiary, Rea Magnet Wire Co, Inc. **Robert R. Cope** has been named manager of aluminum prod-

ucts for Rea; and **Irving O. Schaefer** head of the electrical windings laboratory at Rea's Fort Wayne, Ind., works.

Daystrom Inc's Weston Instruments Division has made **Joseph C. Fiege** manager of the Albany, N. Y., district office and **A. R. Walthers** manager of the Buffalo, N. Y., district office. **John G. Morey** has joined the division in Newark, N. J., as sales research and development coordinator.

OBITUARY

Morris T. Reeves, 53, manager of residential sales, Engineering Division, Georgia Power Co . . . **Louis B. Round,** 72, retired president, Pennsylvania Power Co . . . **George A. Menard,** former vice president, Memco Engineering & Manufacturing Co . . . **James F. Carson,** 85, former vice president, American & Foreign Power Co . . . **Vernon M. Murray,** 63, Seattle area manager, for Bonneville Power Adminisration . . . **Ken A. Timm,** assistant communications engineer, Idaho Power Co . . . **George Dewey Glass,** 62, superintendent of Kentucky Utilities Co's E. W. Brown generating plant and Dix Dam hydro station . . . **Thomas Firth,** 81, retired engineer for Public Service Electric & Gas Co . . . **Philip H. Weinberg,** 66, former industrial sales engineer for Philadelphia Electric Co . . . **Cecil Nelson Parker,** 58, planning engineer, California Electric Power Co. . . . **William E. Myers,** 75, retired general manager, Greenwood district, Public Service Co of Indiana . . . **Orville A. Alderman,** 63, retired Western Division manager for Bussman Manufacturing Co . . . **John Graff,** 68, former owner and operator of Seward (Alaska) Light & Power Co . . . **Adrian A. Buck,** representative for Continental-Diamond Fibre Corp . . . **Joshua Brown,** 82, retired district manager, Oklahoma Gas & Electric Co . . . **Robert M. Owens,** 81, former engineer for General Electric Co . . . **Jayson C. Balsbaugh,** 58, former associate professor of electrical engineering at Massachusetts Institute of Technology.



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miniaturized
ANNUNCIATORS *for*
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Radar Relay offers an outstanding development in Visual Communication Systems. One-third the size of current units, Radar Relay annunciators, now with solid state circuitry, can do a variety of jobs. For instance, for utility applications, they can display conditions such as bearing temperatures, boiler feed and oil flow status. Radar Relay specializes in providing at-a-glance information—from eye-to-brain—to safeguard as well as control vital processes.

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RADAR RELAY INC.

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Today a Cadet, Tomorrow a Boss (*Continued from page* 38)

All the former cadets mentioned, both engineering and analyst, have had the opportunity to acquire experience in two or three actual jobs, in which they met the challenges of varied situations in their chosen lines. Most vacancies on the top management level will continue to be filled from below.

This program has been designed to offer on-the-job opportunities to engineering, business administration, accounting, and liberal arts graduates, all of whom start work immediately on some interesting facet of work in their elected fields. Work assignments are changed after six months or a year, furnishing the cadet with a fuller understanding of the company as well as greater experience in his chosen area.

Starting salary is set at a competitive level, and the program guarantees rises every six months for the first two years, along with outstandingly liberal employee benefits. The cadet meets management regularly to learn from it more about all sides of the business, and at semi-annual meetings with the Management Development Panel, his progress is reviewed and evaluated.

Since the cadet program was resumed in 1949, only five out of 184 accepted men have been asked to resign, most of these for personality difficulties which developed after their employment. More than 70% of the cadets have remained with the company.

New Electric Runabout Developed

A "minimal transportation" electric car for the housewife doing neighborhood chores has been built by Detroit Testing Laboratory, Inc.

Specifically designed for short-distance travel, the car would sell for from $500 to $800 if mass-produced. The Laboratory is presently looking for a manufacturer for its product.

The car weighs 447 lb, is 24 in. high, and has a ⅓-hp, 12-v compound motor for each rear wheel. Top speed is 15 to 20 mph.

A one-wheel trailer with a 2½-hp gasoline engine-generator can be attached to the rear of the car in about 10 min for extended mileage. Normally the batteries require re-charging every two hours.

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Cost Trends—Special Studies—Reports for Rate Cases, Security Issues, Regulatory and Accounting Requirements
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Nation Wide Mapping Services
• Utility Area Base Maps
• Symbolized System Portrayal
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Structural Design • Studies • Supervision
Power Stations • Transmission • Distribution
Industrial Plants • Process
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1—1000 kva Westinghouse, 1/13800/480
2—1000 kva Westinghouse, 1/13800/2400/4160Y
3—1000 kva Standard, 1/44000/8900
3—1000 kva Standard, 1/69000/4160Y/2400
3—1000 kva Standard, 1/34400/480
3— 833 kva Allis Chalmers 1/60/12,000—480
1— 200 kva Westinghouse, 4800—240x480
3— 100 kva G.E., 2400/4160Y—120x240
3— 75 kva G.E., 2400/4160Y—120x240

ERIE ELECTRIC CO., INC.
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OFFICIAL PROPOSALS

Bids: September 14, 1960

Sale of Substation Equipment and Construction Power Transmission Line Materials

POWER AUTHORITY OF THE STATE OF NEW YORK
ADVERTISEMENT FOR PROPOSALS

The Power Authority of the State of New York is offering for sale, to the highest bidder, the following substation equipment and transmission line materials:

One (1) Metalclad 13.8 KV Outdoor Type Switchgear.
Six (6) 15 KV Load Break Switches.
Twelve (12) 15 KV Lightning Arrestors.
Six (6) 115 KV Fuse Mountings, single hook stick operated, complete with power fuses.
Four (4) 115 KV Disconnect Switches.
One (1) Lot of Transmission Line Material.

Those items were placed in service June 1955, in a transmission line and substation used to supply construction power to the St. Lawrence Power Project, and removed from service December 1958. They have now been disassembled and moved to areas at the Robert Moses Power Dam, which is located approximately 10 miles north of Massena, N. Y., where they may be inspected.

The power circuit breakers, the storage battery and the rectifier type battery charges for the switchgear, presently stored inside plant buildings, will be moved by the Power Authority to the ground floor level for loading by the buyer.

Brief descriptions of the items which are offered for sale, and proposal forms for use in bidding are available from Uhl, Hall & Rich, Post Office Box 68, Massena, New York. The descriptions are derived from the original purchase specifications and no guarantee as to the "as is" condition is implied or will be given. Bidders should inspect the equipment and material at the site before submitting proposals. All items will be sold on a "Where is, as is" basis and no claims for adjustment of sale price will be considered on account of any of the equipment being damaged, deteriorated or altered.

Bids will be considered for all or any of the items or for such combination of items as the bidder may elect to make. The right is reserved to make award on any bid or combination of bids and to reject any or all bids.

Bids will be received only in writing and must be received prior to 12:00 Noon E.D.S.T., September 14, 1960, in order to be considered. Bids or requests for additional information should be addressed to:

UHL, HALL & RICH, Engineers for
the Power Authority of the State of N. Y.
P. O. Box 68
Massena, New York

Successful bidders will be required to make payment in full within ten (10) days after the acceptance of their offers and to remove from Authority Property within thirty (30) days the item or items purchased.

W. S. CHAPIN
GENERAL MANAGER

SEARCHLIGHT SECTION

(Classified Advertising)

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EQUIPMENT WANTED or FOR SALE ADVERTISEMENTS acceptable only in Displayed Style.

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PROPOSALS, $1.80 a line an insertion.

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DISCOUNT OF 10% if full payment is made in advance for four consecutive insertions of undisplayed ads (not including proposals).

Send New Advertisements to Classified Advertising Div. of Electrical World, P. O. Box 12, N. Y. 36, N. Y.

POWER PLANT ENGINEER

Mechanical or Electric Engineer with sufficient experience to supervise operation and maintenance of steam power plant. Personnel Dept., Ark-Mo Power, Blytheville, Ark.

UTILITY OPERATIONS EXECUTIVE

Consulting firm has opening for highly capable electric operations executive, qualified for Vice President, E.E. degree minimum. Full knowledge of production and field operations and administrative ability required. Preferably under age 50. Salary open. Replies will be held in confidence.

P5205 Electrical World
520 N. Michigan Ave., Chicago 11, Ill.

ADDRESS BOX NO. REPLIES TO: Box No. Classified Adv. Div. of this publication. Send to office nearest you.
NEW YORK 36: P. O. Box 12
CHICAGO 11: 520 N. Michigan Ave.
SAN FRANCISCO 4: 68 Post St.

POSITIONS VACANT

Electrical Engineer, Board layout work—power, lighting, and control systems; calculations; and occasional field contacts. Extremely wide variety of work with opportunity to enter consulting field and grow with progressive mid-western concern. P-4617, Electrical World.

Power Accountant: Middle East location. Assist Chief Power Accountant to establish, maintain accounting records comparable FPC system, and train local personnel. Knowledge of, and several years of experience with, accounting procedures required, familiarity with electric construction materials and their use, and with utility and plant accounting very desirable. Two-year contract with other benefits. Salary from $13,530 per year based on ability and experience. P-5194, Electrical World.

Electrical Engineer by Northeast Municipal Utility, serving 10,000 customers, to do engineering and serve as assistant manager. Must have executive ability and a general knowledge of all electric utility operations, including steam plant operations and maintenance, as well as design, construction, maintenance and operation of electric distribution system. Permanent position carrying substantial opportunity for qualified person. Liberal salary and retirement plan offered. Applicants under 40 with BSEE degree preferred. Address experience and education record to P-5209, Electrical World.

SELLING OPPORTUNITY AVAILABLE

Representative wanted for manufacturer of street lighting equipment pole line specialties. Western States. Full particulars. RW-5056, Electrical World.

POSITIONS WANTED

Electrical Engineer, BSEE, MBA, 36, 12 years experience in electric utility operations, construction, and system planning engineering. Capable, high potential, friendly. Location open. PW-5084, Electrical World.

EMPLOYMENT . . . EQUIPMENT . . . BUSINESS
OPPORTUNITIES
Whatever your need—
think "SEARCHLIGHT" FIRST

BECHTEL

Los Angeles or San Francisco

The Los Angeles and San Francisco Power and Industrial divisions of Bechtel Corporation require the services of qualified mechanical, electrical and civil/structural engineers. Qualifications must include recent experience in steam power plant or similar heavy industrial work.

Relocation allowances cover moving costs plus transportation reimbursement for you and members of your family. If you have an interest in a San Francisco or Los Angeles assignment, please send a resume of experience, including your present and required salary, to George I. Copeland, Manager of Personnel. Personal interviews will be arranged for qualified candidates.

Bechtel
Corporation
220 Montgomery Street
SAN FRANCISCO

A RARE OPPORTUNITY FOR

Either a SALES ENGINEER with Transmission and Distribution Line Construction experience, or an ELECTRICAL LINE FOREMAN or SUPERINTENDENT who thinks he can sell.

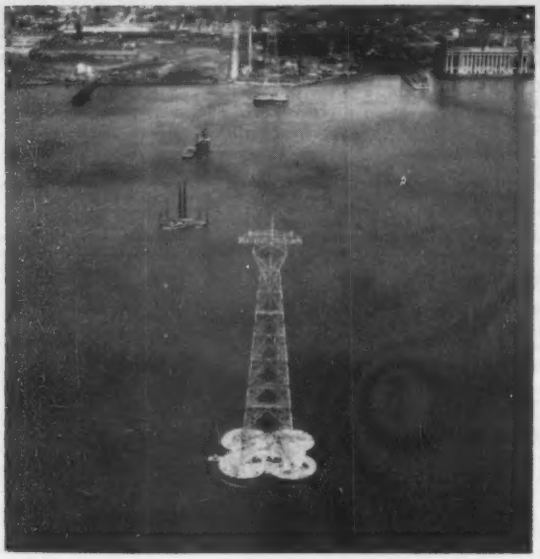
If you have the above qualification and are willing to travel, a progressive West Coast manufacturer whose products are leaders in their field used by power and telephone companies has an opening in the Southwestern States which includes California, Arizona, Utah, and Nevada with headquarters in or about the metropolitan area of Los Angeles. Salary, Expenses and incentive bonus. Also many company benefits. If this interests you, write for an interview.

P-5144, Electrical World
68 Post St., San Francisco 4, Calif.

WANTED
ELECTRICAL OPERATING EXECUTIVE

Need retired operating executive, with experience in operation of distribution plant and in management at division level, to operate for about one year, electric utility, which distributes purchased power. Specific duty will be to set up efficient operating force and train successor. Salary approximately $10,000. Location Eastern U. S.
P-5082, Electrical World
Class. Adv. Div., P.O. Box 12, N.Y. 36, N.Y.

5,584-ft Delaware River Crossing Provides New 220-Kv Link



Two large steel suspension towers will soon link transmission lines of the Philadelphia Electric Co and Atlantic City Electric Co across the 4,200-ft-wide Delaware River.

To comply with minimum ship channel clearance and height limits set by nearby International Airport, the conductors will have to be between 210 and 350 ft above the river.

Designed for 220 kv, the line will be initially operated at 132 kv. It will provide an additional outlet for Philadelphia Electric's Eddystone station, increase service reliability, and provide an important link with New Jersey utilities.

The suspension towers of the 5,584-ft aerial crossing are located on man-made islands just south of Philadelphia, while two 150-ft-high anchor towers are located well inshore.

The towers provide a main span of 2,754 ft and backspans of 1,730 and 1,100 ft. The 350-ft-high suspension towers are designed to withstand wind loadings up to 45 lb per sq ft. Combined weight of the four towers is about 500 tons.

Network Protection Satisfies 480-V Needs (*Continued from page* 33)

Fewer components and simpler wiring.

The relays, connected to the system voltage without intervening potential transformers, see the exact voltage differentials and phase angles.

With a few simple wiring changes, this variation of protector can be converted for 216-v service. This is a definite inventory advantage for users stocking complete roll-out units as spares.

These are the advantages of the 216-v relays with potential transformers:

Most users considering the use of 480-v networks operate 216-v systems. Therefore, spare 216-v relays are available. This, however, would be at least partly offset were spare autotransformers stocked.

Laboratory and field testing equipment was designed for testing 216-v relays. Unless test equipment of recent design is available to test at any voltage, installing 480-v test equipment incurs additional expense.

More stringent safety rules may be required for 480-v relay testing. This can be avoided by continuing with the use of 216-v relays.

Besides the six autotransformers more than 20 additional wires are required to connect extra components in their respective circuits of the 216-v relay design. The extra components and wiring are entirely eliminated with 460-v relays. Thus the decision as to which network protector to select can be focused in this question: Is the immediate saving in new test equipment and spare relays worth operating with the added complexity necessitated by adapting relays designed for 216 v to the higher-voltage application?

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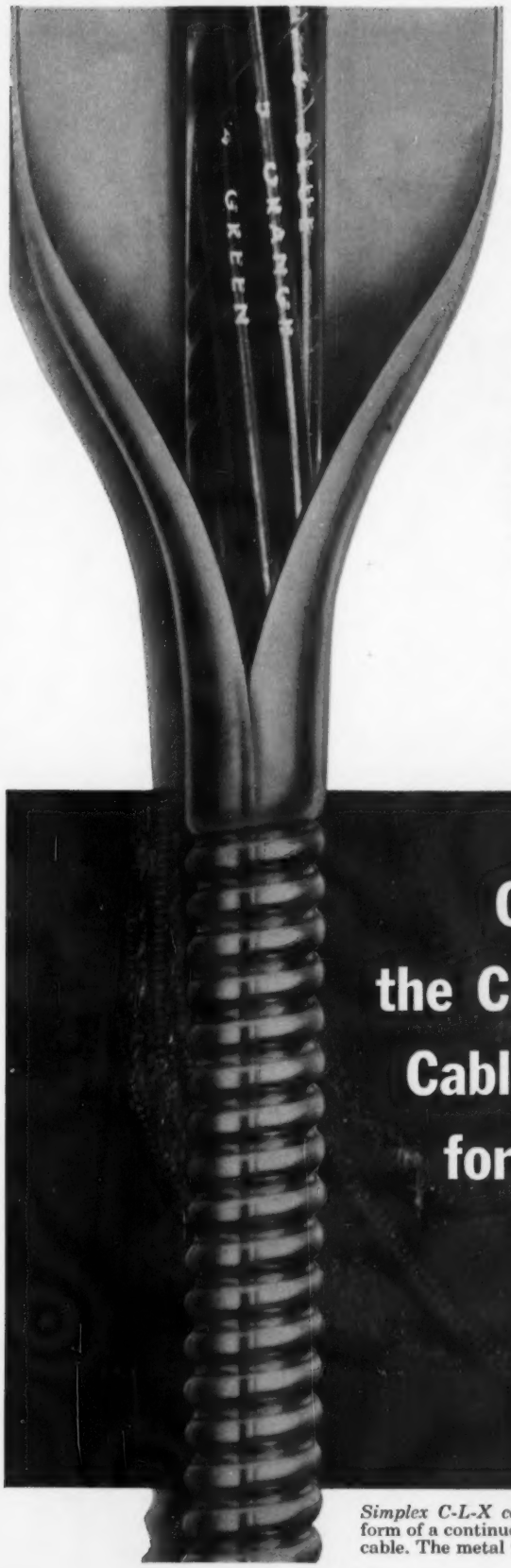

The cable you see here is *not* interlocked armor. It is Simplex' new C-L-X . . . the completely sealed cable system.

- Completely sealed against liquids and gases.
- Protected against mechanical damage by a continuous, corrugated metallic sheath.
- As pliable as unsheathed cable because of its corrugated design.
- Needs no separate duct or conduit in any environment.
- Nonferrous sheaths can be designed to function as grounds or shielding.

Simplex C-L-X is impervious to liquids and gases, is resistant to all forms of mechanical damage, and is as pliable as unsheathed cable.

Available with sheaths of steel, aluminum, copper or bronze, and with or without outer plastic jacketing, Simplex C-L-X provides the ideal solution for almost any installation, particularly those in which cable life is limited by severe ambient conditions.

Write today for illustrated brochure containing application and engineering information.

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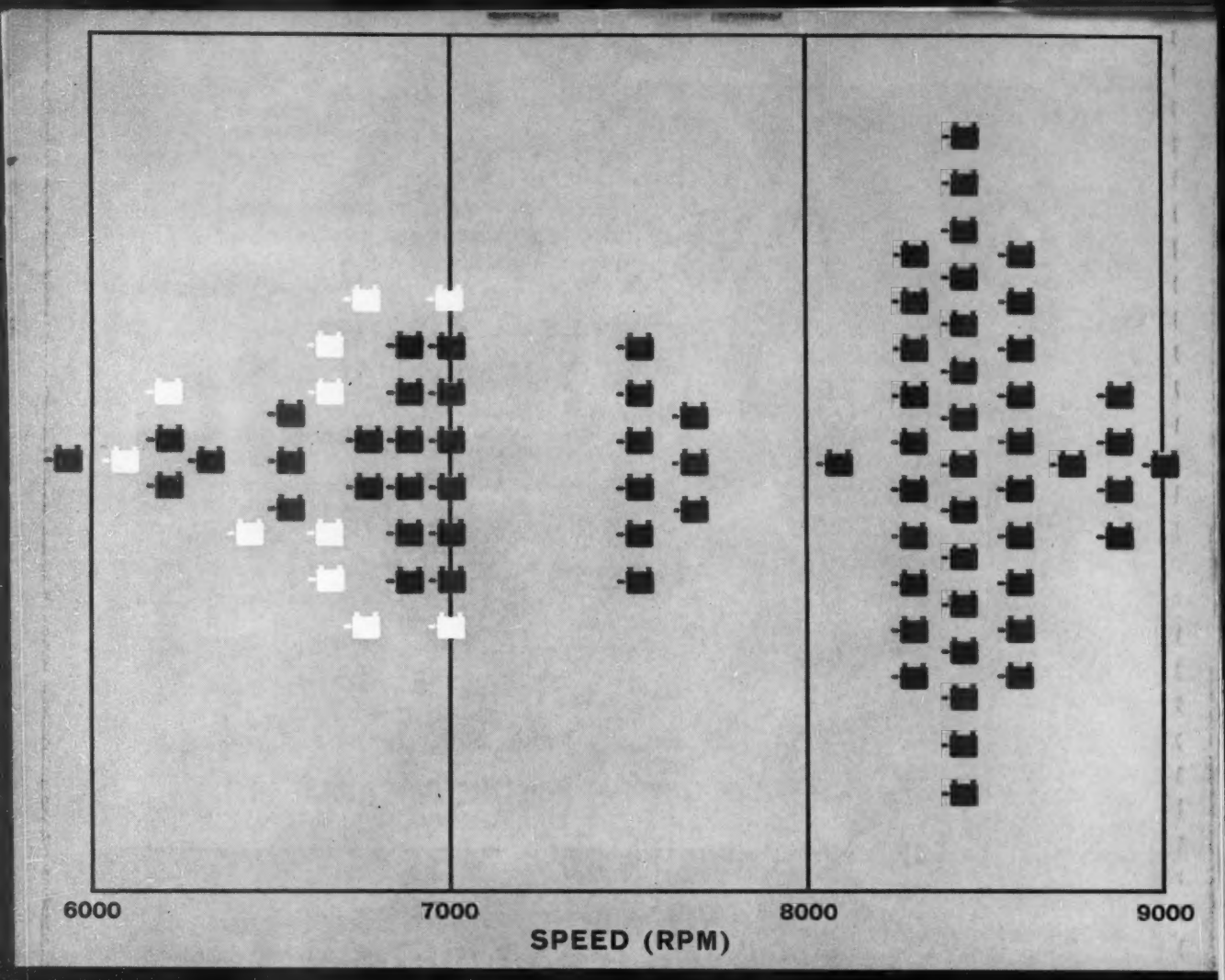
Only Simplex C-L-X . . . the Completely Sealed Cable System . . . is Built for Torturous Conditions Like This

Simplex C-L-X combines cable and duct in one integrated system. Metal, in the form of a continuous flat strip, is formed into a welded tube around the insulated cable. The metal tube is then corrugated to form Simplex C-L-X.



WORTHINGTON MAKES 6 OUT OF 7 HIGH SPEED BOILER FEED PUMPS

The trend in boiler feed pumps today is to higher speeds. This provides the higher pressures needed in today's power generating equipment. An important side benefit is that it permits boiler feed pumps to be turbine driven at optimum turbine speeds. And it offers much better opportunity for standardization of equipment, including the benefit of fewer stocked parts.

In over 80 high speed boiler feed pump central station installations, above 6000 rpm, already made or on order, six out of every seven pumps are built by Worthington. And this includes two out of every three main-shaft-driven units.

Why does Worthington lead? Because of its design philosophy. It alone has taken these pumps to 9000-rpm speeds.

A Worthington design begins with minimizing shaft span, maximizing shaft diameter and keeping generous running clearances—all to reduce deflection and improve reliability. Next comes attention to critical areas: impellers are shrunk on shafts for strength and leakage prevention; metal-to-metal ring-type joints eliminate gasket failure; a balancing device compensates for axial thrust and special bearings eliminate vibration caused by oil-whip.

Other features, too, such as freedom for thermal expansion and machined twin volutes add to Worthington high-speed boiler feed pump reliability.

In a booklet just printed Worthington discusses "The ten most important features in boiler feed pumps today." From it you'll quickly understand why boiler feed pumps are now freed from the traditional 3600-rpm limitation. And you'll read basic design considerations that will help you in boiler feed pump selection. Write Worthington Corporation, Dept. 45-16, Harrison, New Jersey.

WORTHINGTON